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Examining Multiple Identities Under Stereotype Threat – A Regulatory Fit Perspective

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EXAMINING MULTIPLE IDENTITIES UNDER STEREOTYPE THREAT – A REGULATORY FIT PERSPECTIVE

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Dedication

To my dad, Eugene Reinhart, who is both my rock and my idol. Because of you, I found the confidence to reach for the stars.

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Examining Multiple Identities Under Stereotype Threat – A Regulatory Fit Perspective

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This study sought to examine how underlying characteristics of multiple social identities could explain why some people are not affected by stereotype threat. Specifically, it proposed that different identities are not only associated with positive or negative stereotypes, but also different regulatory foci. It additionally sought to address a common methodological issue in the literature by including non-targets of stereotype threat as a comparative group.

Using a quantitative experimental design, math-identified male (N=104) and female (N=172) university students were randomly assigned to take a difficult math test under circumstances which varied both reward structure and salient identities. For math-identified females, their gender identity was believed to invoke a negative stereotype about female math ability and thus stereotype threat. However, college identity was proposed to be positively stereotyped about ability. When both were made salient, females would suppress their gender identity in order to maintain a good self-concept and would thus be protected from stereotype threat effects. Furthermore, it was predicted

females under threat would enter into a prevention regulatory focus and thus perform better under a reward structure which focused on minimizing losses.

A major criticism of stereotype threat research is that it fails to differentiate itself enough from stereotype priming. While the two are similarly activated, stereotype threat only affects those for whom the stereotyped identity is relevant. Thus it is important to include non-targets of threat to ensure that the experimental manipulations do not affect them. Males were included in this study because the negative stereotype about female math ability is not relevant.

Results indicated that when gender identity was made salient, math-identified females performed worse than a control group. However, when both gender and college identity were made salient, math-identified females performed better than those only reminded of their gender, and equivalent to those in a control group. Reward structure showed no main effect on performance. While the interaction between identity salience and reward structure was marginally significant, more research is needed to determine if there is a true relationship. Males showed no differences across conditions however, which indicates this was a more valid manipulation of threat.

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Chapter 1: Introduction

BACKGROUND

In her 2013 book, *Lean In*, Sheryl Sandberg posits that a contributing factor to the gender gap in career progression and compensation is that women are holding themselves back because of stereotypes – that either women cannot perform equal to men, or that they should not. Similarly, despite numerous efforts to attract more females to science and technical professions (areas where men are stereotyped to have greater natural ability), women are still less likely to pursue those domains than men. In fact, women who are subtly reminded of their gender identity have shown stereotype-consistent attitudes towards interest in arts over math academic domains (Steele & Ambady, 2006). Some research has proposed that the priming of social categories, such as gender or race, can lead to changes in behavior or interest in certain academic domains (Wheeler, DeMarre, and Petty, 2004; Steele & Ambady, 2006). When these stereotypes are negative *and* are personally relevant, they can even lead to reduced performance in, and after time, disidentification with a domain (Steele & Aronson, 1995; Steele, 1997; Major, Spencer, Schmader, Wolfe, & Crocker, 1998; Spencer, Steele, & Quinn, 1999). This phenomenon of performing worse when one is trying to not confirm a negative stereotype about themselves is known as *stereotype threat*, and has been studied in everything from female performance in math, to African American performance in general academics (Steele & Aronson, 1995; Spencer, Steele, & Quinn, 1999).

But what about women like Sandberg – those who manage to thrive in spite of these stereotypes? It has been suggested that traditional literature which focuses on the contributing factors that lead to harmful effects fails to explain why some are resilient to these threats (Shih, 2004). If our concern is in how to counteract or buffer the effect, then

it is necessary to understand what processes are used by those who overcome it. For example, it has been suggested that making a positively stereotyped[1] aspect of one's identity more salient in threat situations could result in the negative stereotype having no effect (Shih et al., 1999; Rydell, McConnell, & Beilock, 2009). However, this finding has not been consistently shown in the literature (Cheryan & Bodenhausen, 2000). Borrowing from literature on identity development and resilience in African Americans, the development of multiple identities has been identified as a possible protective factor (American Psychological Association, 2008). Perhaps it is the accessibility of an alternative identity, with a more positive association which might make this difference. Therefore, more research is needed to understand not only why negative stereotypes sometimes do not impair performance, but to understand why sometimes positive stereotypes do. *Following a line of research that investigates self-regulatory strategies as a possible moderator of stereotype threat, this research study proposed that different stereotyped identities have different associated regulatory foci.*

STATEMENT OF THE PROBLEM

Research on stereotype threat has failed to reach consensus on the role of positively stereotyped identities on performance under threat (Cheryan & Bodenhausen, 2000; Shih, Pittinksky, & Ambady, 1999; Rydell, McConnell, & Beilock, 2009). *The present study seeks to examine the role of regulatory focus and its relationship to different identities that can be invoked under stereotype threat.* It intends to look at the unique characteristics of different identities to try and explain why some positive

[1] Although stereotypes and overgeneralizations of groups of people are unsavory, for the purpose of this dissertation, positive stereotypes would be generalizations which promote the idea of one group having a greater ability over another group, and negative stereotypes are those that promote an idea that a group has inferior ability. While not promoting the use of stereotypes as an intervention, this dissertation seeks to understand the cognitive functioning of stereotypes and how positive identification can possibly mitigate the effects of negative stereotypes on performance.

stereotypes lead to better performance under threat, but some actually lead to "choking." Additionally, this study seeks to address certain methodological limitations of previous work, specifically the use of explicit instead of implicit stereotype priming (Rydell, McConnell, & Beilock, 2009), a lack of inclusion of non-targets of threat for comparison (Cheryan & Bodenhausen, 2000; Shih, Pittinksky, & Ambady, 1999), and a lack of a measurement to determine if study subjects felt any self-threats under manipulation (as discussed by Marx, 2011). Explicit priming of stereotypes may affect any population – the stereotype does not have to be relevant (Marx, Stapel, & Muller, 2005), such as students who are primed with traits of "hooligans" performing worse than students who are primed to think of a university professor (Dijksterhuis & van Knippenberg, 1998). While stereotype threat may still occur under explicit priming for those who the stereotype is relevant, to make conclusions about threat, a study needs to include participants for whom the stereotype is not relevant (non-targets) as well as a measure of self-threat, a key issue addressed in this dissertation.

THEORETICAL FRAMEWORK

The proposed study is grounded in three theoretical frameworks, which will guide study design and inclusion of specific measurements. Tajfel and Turner's (1986) *social identity theory* explains how our self-concept is associated with membership in social groups and categories (Hogg, 2005). Social identity theory can be broken down into two main frameworks: one which examines intergroup relations, and one which examines social identity of the group (self-categorization theory). Two key aspects of this theory are relevant to the current work: (1) that we are motivated to have a positive image of ourselves, and (2) that when confronted with a negative stereotype about a group with

which one identifies, a possible result is to suppress that identity (basically leave that social group) and increase identification with a more positively viewed group.

Steele and Aronson's (1995) *stereotype threat theory* describes the situation where individuals are at risk of confirming a negative stereotype about a group with which they identify. In other words, the possibility of having one's performance judged in terms of a negative stereotype may invoke negative emotions (Steele, 1997; Inzlicht & Schmader, 2011). However, effort to not confirm the stereotype can actually lead to a decrease in performance (Steele & Aronson, 1995). There is still much to be understood about the underlying processes of stereotype threat effects, however two main features of the theory specifically guide this proposed study: that for stereotype threat to occur, it must be (1) self-relevant and (2) the task must be sufficiently difficult (or framed as diagnostic of ability), as any struggles in performance cause one to be concerned that the negative stereotype might actually be true (Nguyen & Ryan, 2008; Steele & Aronson, 1995; Steele et al., 2002).

Lastly, Higgins' (1997) *regulatory focus theory* is used in this proposed study to try and explain why sometimes stereotype threat has no effect on a target population. Regulatory focus theory describes how we employ self-regulatory strategies to reduce discrepancies between our actual self (as we perceive it) and an idea of how we should or would like to be. This theory is based on the idea that humans have a natural desire to seek pleasure and avoid pain, but that we use different strategies when we are motivated for either nurturance or security. For concerns of nurturance, which are related to reducing discrepancies between our actual self and some ideal idea of the self, we use promotion regulatory strategies. These strategies are more concerned with the presence or absence of positive outcomes. For concerns of security, or to reduce discrepancies between our actual self and an idea of how we ought to be, we employ prevention

strategies. Prevention strategies are more sensitive to the presence or absence of losses. Furthermore, this theory proposes that when our reward structure matches our regulatory focus, we are more motivated and perform better.

Following a line of recent research (Seibt & Förster, 2004; Grimm et al., 2009), it has been suggested that a lack of fit between regulatory focus and reward structure could explain why some experience stereotype threat. If this is indeed true, then those unaffected by threat must be experiencing regulatory fit. Research on regulatory fit has suggested that different social groups have different associated regulatory foci (Lee, Aaker, & Gardner, 2000), and that a regulatory focus can be induced to match what is considered the group norm (Faddegon, Scheepers, & Ellemers, 2008). Therefore, if a more favorable identity is invoked (as reasoned by social identity theory) and this leads to a buffer against threat, then the salient identity must have a regulatory focus which matches the reward structure.

SIGNIFICANCE OF THE STUDY

Chronic exposure to negative stereotypes can lead to disidentification with a group, including academic disidentification (Steele & Aronson, 1995; Steele, 1997; Spencer, Steele, & Quinn, 1999; Cokley, 2002). If we can identify protective factors which could be invoked under stereotype threat, such as encouraging someone to think of a positively stereotyped aspect of their identity, this could potentially lead to interventions which would decrease the chances of this disidentification. To be able to move towards designing interventions however, there first needs to be consistency among the literature to ensure that we are in fact studying stereotype threat and not another phenomenon. Additionally, discovering why some people are resilient to threat is a major step in progressing towards an effective intervention. This study is significant in that it

re-examines some of the inconsistencies in previous work and provides a possible underlying explanation for the discrepancies.

Despite the body of literature on stereotype threat, there still remain many unanswered questions as well as inconsistencies in findings. This could be in part due to an inconsistent way in how we define and invoke threat. It has been argued that many studies may be examining a different set of processes – that of stereotype priming, which does not need to be self-relevant and can often produce opposite results from threat (Marx, 2011). Stereotype priming involves taking on behavioral characteristics of an invoked stereotype about a group with which one may or may not identity (Dijksterhuis & van Knippenberg, 1998); stereotype threat involves behavior that can decrease performance when one is trying to avoid confirming a negative stereotype about a group with which they identify (Steele & Aronson, 1995). This is not to say that they cannot occur concurrently, but methodology should ensure that we are differentiating between the two. There is a need for research that addresses these methodological limitations by including participants for whom the negative stereotype would not be relevant, as well as a measure of self-threat.

Another area of the literature needing more empirical evidence is that on the role of positive stereotypes in stereotype threat situations. It has been suggested that positive stereotypes may act as a buffer against threat because they offer an alternative aspect of one's identity with which to align (and thus suppress the negative aspect; Rydell, McConnell, & Beilock, 2009). However, there is disagreement in the literature regarding whether positive stereotypes can help (Shih, Pittinsky, & Ambady, 1999) or hurt (Cheryan & Bodenhausen, 2000) performance. Therefore, more research is needed to try to determine what the role is, as well as to identify the underlying processes that could explain differential outcomes.

RESEARCH QUESTIONS

This research study sought to address the following questions:

Research Question 1: *How does the performance of targets and non-targets of stereotype threat vary when the negatively stereotyped identity is salient under stereotype threat?*

Hypothesis & Rationale. Consistent with the literature (e.g., Steele & Aronson, 1995; Spencer, Steele, & Quinn, 1999), when situational cues indicate that one might be at risk of confirming a negative stereotype about a group with which they identify, it can lead to a decrease in performance. This effect should not hold for non-targets however (Marx, 2011), as stereotype threat is only present when a negative stereotype is self-relevant. Therefore it was predicted that under stereotype threat, target performance would decrease. Threat should have no negative effect on non-targets.

Research Question 2: *To what extent can the performance of targets under stereotype threat be modified by the reward structure of the task?*

Hypothesis & Rationale. As previous literature has proposed, targets of threat enter a prevention regulatory focus when a negative stereotype is made salient (Seibt and Förster, 2004; Grimm et al., 2009). If this is true, then decreased performance might actually be due to a misalignment between the reward structure of the task and the induced regulatory focus (Grimm et al., 2009). These decreases should be negated however, under a reward structure which emphasizes minimizing losses, by creating a regulatory fit (Higgins, 1997; Shah et al., 1998; Keller & Bless, 2006). Based on this, it was predicted that when a negatively stereotyped target group was in a threat situation, their performance would be worse under a gain/no-gain reward structure, but not worse under a loss/no-loss reward structure.

Research Question 3: *When a negatively stereotyped identity is made salient along with a positively stereotyped identity, how will performance be affected?*

Hypothesis & Rationale. According to social identity theory (Tajfel & Turner, 1986), humans want to retain a positive image of themselves and can decrease their identity with a group that is negatively stereotyped and increase their identity with a more positively identified group (Rydell, McConnell, & Beilock, 2009). Hence, when both a positive and negative stereotype are salient, one will choose to align themself with the positive identity. This in turn should lead to improved performance. Therefore it was predicted that when a negatively stereotyped target group was reminded of a positively stereotyped identity, they would perform better.

Research Question 4: *How does the effect of a positively stereotyped identity on performance vary by regulatory focus?*

Hypothesis & Rationale. It has been proposed that different identities can have different regulatory foci (Lee, Aaker, & Gardner, 2000). Furthermore, a collective regulatory focus can be developed over time based on the reward structure associated with that group – for example, as academics in the United States are more focused on rewards and gains, it could be argued that an academic identity would be associated with a promotion regulatory focus. If a positively stereotyped identity is associated with a promotion focus, and if it is adopted under threat (in lieu of the negative one), performance will be better under a gain/no gain reward structure. Therefore, it was predicted that when a positive stereotyped identity associated with a promotion focus was made salient, targets of threat would align themselves with this identity and thus perform better in a gain/no-gain reward structure.

DEFINITION OF TERMS

For the purpose of this study, terms of interest are defined as follows:

Stereotype threat: "Being at risk of confirming, as self-characteristic, a negative stereotype about one's group" (Steele & Aronson, 1995).

Stereotype lift: When performance of a non-target group is increased by making a negative stereotype about a target group salient (Walter & Cohen, 2003).

Stereotype boost: When performance of a target group is increased by making a positively stereotyped identity more salient (Gonzales, Blanton, & Williams, 2002; Shih, Pittinsky, & Ambady, 1999).

Regulatory focus: A self-regulatory orientation that uses one of two types of strategies to reduce discrepancies between our actual self and our ideal/ought selves (Higgins, 1997).

Prevention focus: A regulatory focus where concerns are related to reducing discrepancies between the actual self and an ought self; individuals are more concerned with the presence or absence of losses (Higgins, 1997; Spoor, 2006).

Promotion focus: A regulatory focus where concerns are related to reducing discrepancies between the actual self and an ideal self; individuals are more concerned with the presence or absence of positive outcomes (Higgins, 1997; Spoor, 2006).

Regulatory fit: The situation where strategies used or the rewards given for attaining a goal complement one's regulatory focus (gains/non-gains for a promotion focus but losses/non-losses for a prevention focus; Keller & Bless, 2006).

ORGANIZATION OF THE STUDY

The first chapter of this dissertation has presented the introduction, statement of the problem, definition of key terms, and limitations. The second chapter contains a review of relevant literature and research, including stereotype threat, stereotype threat

and how it relates to identity, regulatory focus, regulatory focus and how it possibly relates to stereotype threat, and regulatory focus and how it relates to identity. The review also includes limitations of previous research, namely issues with previously used methodology which make it hard to differentiate much of the research on stereotype threat from research on stereotype priming. The methodology and procedures used to gather data, analyze, and model the relationships are presented in the third chapter. Results of the analyses and modeling technique are discussed in the fourth chapter, and a summary of the study and findings, with conclusions drawn, a discussion, and recommendations for future research are in the final chapter.

Chapter 2: Literature Review

Introduction

While stereotype threat has been widely studied, there remains not only much to understand about the underlying processes, but also a need for a more consistent definition of what threat is and is not. Included in this gap of research are the effects of positive stereotypes, which is an area that needs considerable research in order to help develop a more complete picture about how stereotypes as a whole affect us (Shih, Pittinsky, & Ho, 2013). For example, why do positive stereotypes sometimes boost performance (Shih et al., 1999; Rydell, McConnell, & Beilock, 2009), yet in other situations depress it (Cheryan & Bodenhausen, 2000)? What are the underlying mechanisms and boundary conditions of stereotype effects? Perhaps how a stereotype is invoked, as well as the characteristics associated with the stereotyped identity, could help explain why some of these differential effects exist. The following literature review discusses the history of research on the effects of stereotypes, current research on negative and positive stereotypes, as well as proposed moderators of their effects, specifically regulatory focus.

Stereotype Threat Theory

In 1995, Claude Steele and Joshua Aronson published one of the seminal pieces of modern psychological literature and introduced the term, *stereotype threat*. Steele and Aronson defined stereotype threat as "being at risk of confirming, as self-characteristic, a negative stereotype about one's group," and proposed that this self-evaluative threat could potentially lead to a decrease in performance by members of the stereotyped group, regardless of whether the person actually believed the stereotypes or not. The authors drew upon decades of literature examining racial bias in standardized testing, which

repeatedly showed that scores on tests designed to measure scholastic preparedness – such as the Scholastic Aptitude Test (SAT) – were consistently over-predicting Black students' subsequent achievement. In other words, despite having equal preparation, there was a significant achievement gap between Blacks and Whites. Steele and Aronson suggested that something, perhaps the chronic exposure to negative stereotypes concerning the academic abilities of Blacks, was at the center of this divergent trend. Earlier work which looked at the psychological effects of desegregation on Blacks had shown differential performance on IQ tests by Black participants based on the framing of the purpose of the test (Katz, Roberts, & Robinson, 1965; Steele & Aronson, 1995); when a test was presented as an evaluation of hand-eye coordination, Black participants scored higher than when it was presented as a measure of intelligence.

Building on this earlier work, Steele and Aronson proposed that for Black students who aligned their personal sense of achievement and identity with a particular skill, negative stereotypes added a degree of "self-threat" to a testing situation which would not be experienced by their White peers. To test this theory, they conducted a series of four experiments that manipulated the perceived purpose of the test (whether to evaluate ability or not), as well as the ability to link their performance with their racial group. They then examined the effects on test performance, perception of performance, and arousal of stereotype threat. The first experiment managed to replicate previous findings, that when a test was framed as diagnostic of ability, Blacks performed worse in relation to their White participants (after controlling for SAT scores). However, that gap in performance disappeared when the test was presented in a way that made no reference to ability. It also showed that participants under the diagnostic condition had both lower estimates of correctly solved problems and a lower perception of their performance relative to their peers. In the second experiment, Steele and Aronson found that under a

diagnostic condition, Black participants completed fewer test items and were both slower and less accurate, but did not differ significantly from the other testing conditions on measures of anxiety, self-reported effort, and cognitive interference. Participants in the third experiment were asked to complete a series of word fragments such as "_ _ C E" after being told that the task was either diagnostic of ability, non-diagnostic of ability, or the link to verbal ability was not mentioned at all. The authors showed that Blacks in the diagnostic condition of the third experiment had a heightened awareness and concern for stereotypes, as compared to the other conditions, and were significantly more likely to complete the word fragments with words that had to do with race or racial stereotypes. For example, Blacks under the diagnostic condition were more likely to complete the fragment "_ _ C E" as "RACE" and the word "_ _ O R" as "POOR." Additionally, these participants were less likely to indicate their racial identity at the end of the test, as it would link their performance to their race. The final study examined whether simply indicating one's race before taking an examination could actually trigger stereotype threat, by either including demographic questions or not before a test that was not framed as diagnostic of ability. The results showed a decrease in performance, number of attempted items, accuracy, and estimate of performance for Blacks who were asked to indicate their race before attempting the items. In summary, Steele and Aronson were able to show that inducing stereotype threat, even by just asking someone to indicate their race prior to taking a test, could dramatically reduce the subsequent performance of Black participants.

As Steele describes (Steele, 2011; Murphy & Jones Taylor, 2011), the initial goal of stereotype threat research was to determine what factors were leading to black students and women consistently underperforming on standardized tests of ability compared to their white and male peers. Since 1995, stereotype threat has become one of the most

widely studied areas in psychology (Schmader, Johns & Forbes, 2008), to include study of its effects on everything from athletic performance of whites (Stone, Lynch, Sjomerling, & Darley, 1999; Stone & McWhinnie, 2008) to memory performance in the elderly (Levy, 1996), to females underperforming in science, technology, engineering, and mathematics (STEM) fields (Spencer, Steele, & Quinn, 1999; Steele & Ambady, 2006). Some research indicates that even white males, a group not typically marginalized in our society (Inzlicht & Schmader, 2011), can underperform when a test is framed as trying to test Asian superiority in mathematical ability (Aronson et al., 1999).

Stereotype threat has been proposed as one of the contributing factors to gender differences in not only performance on tests of mathematical skills, but also in gender differences in career choices. Those continually exposed to a negative stereotype about an aspect of their identity, such as a mathematics domain identity, can eventually cause disidentification (Steele, 1997). Across seventeen years of research on the mathematics performance of females under stereotype threat (Picho, Rodriguez, & Finnie, 2013), it was found that females systematically score worse on mathematics tests when they are under threat, as compared to a control group. The prevalence of this phenomenon and its possible implications for gender gaps in academic and professional success make it important to better understand the underlying processes of stereotype threat as well as to identify possible interventions to counter its effects.

Criticisms of Stereotype Threat

Despite the large body of research which has shown how stereotype threat can negatively impact performance of marginalized groups, there remain many criticisms of the field (Aronson & Dee, 2013). In addition to stereotype priming which will be addressed later in this chapter, other major criticisms include an overreliance on lab

experiments using university students, difficulty translating to real-world research, the inability to explain the full gap in performance, and failure to distinguish stereotype threat from real discrimination (Stroessner, Good, & Webster, 2014). In regard to the first criticism, while early research (e.g., Steele & Aronson, 1995; Whaley, 1998) focused on college students, who continue to be one of the more readily available populations to study in experimental settings, stereotype threat has been seen across people of different ages (e.g., Ambady, Shih, Kim, & Pittinsky, 2001; Bergeron, Block, & Echtenkamp, 2006) and experiences, and in both lab and real-world settings (Good, Aronson, & Harder, 2008).

There has been criticism that effects found in the laboratory have not translated to real-world settings (Cullen, Hardison, & Sackett, 2004). One study in particular (Stricker & Ward, 2004) showed no performance differences between females on an AP Calculus exam when they indicated their gender either before the exam or afterwards (gender identity was either salient or not when taking the test). However, re-analysis of the data has actually shown that when females reported their gender before taking the AP exam, performance was decreased by roughly 33% (Danaher & Crandall, 2008). Some laboratory research has failed to generalize to the real-world, but as is proposed in this study, this could be because of invalid manipulations of threat in the laboratory. It is important for researchers to address this criticism by providing sufficient evidence that they are actually studying stereotype threat.

In Steele and Aronson's (1995) original work, as well as in many other studies, performance differences were found under threat after SAT scores were statistically equated. There still remained a performance gap between Whites and Blacks, however stereotype threat caused a decrement in performance above and beyond the existing gaps. Stereotype threat research was never intended to fully explain gaps in performance

between genders, races, or other groups. It can however be considered one possible contributing factor. Related to this, stereotype threat research has been criticized for not distinguishing actual discrimination and threat (Whaley, 1998). However, as Steele (1998) has discussed, stereotype threat may actually occur from experiences of discrimination and stereotyping. Stereotype threat can also occur in situations where discrimination is not present, but the individual feels that he or she may be judged unfairly because of past discrimination.

UNDERLYING MECHANISMS OF STEREOTYPE THREAT

Based on the idea that we have multiple social identities (Tajfel & Turner), when situational cues indicate that one particular identity is more valuable or important in a certain setting, that particular group membership becomes more salient (Murphy & Jones Taylor, 2013). Stereotype threat theory proposes that this event causes one to enter a *vigilance phase*, where one seeks additional cues from the environment which indicate if the salient identity is a liability or not. If the identity is determined to not be a potential source of stigma or devaluation, then the vigilance decreases; but if the salient identity is instead determined to be a possible liability, vigilance increases (Murphy & Jones Taylor, 2011).

More recent research has proposed that stereotype threat occurs due to a cognitive imbalance from how one identifies themselves and a potentially conflicting stereotype associated with that identity (Schmader, Johns, & Forbes, 2008). Thus when a female who identifies as being strong at math is confronted with the negative stereotype that females generally have low mathematical ability, this does not fit with her evaluation of herself: *I am female. I am good at math. Females are not good at math*. This disconnect between her perception and the more general perception leads her to not only doubt her

abilities, but also triggers a hyper vigilant state towards not confirming this stereotype (Johns & Schmader, 2010; Schmader & Beilock, 2011).

This hyper-vigilant state can in turn lead to a decrease in working memory (Johns et al., 2008; Schmader & Beilock, 2011) as cognitive resources are used to try and regulate and suppress the negative emotions and self-doubt. Sometimes this heightened vigilance has been shown to be beneficial, such as on tasks where one has time to make corrections to their responses (Jamieson & Harkins, 2007; Schmader & Beilock, 2011). However when trying to complete a complex cognitive task or a task where too much attention is paid to performance (Beilock et al., 2007), this state of hyper-vigilance can decrease performance (Schmader & Beilock, 2011). This idea of attention to accuracy is similar to the idea of a self-regulatory strategy focused on accuracy (prevention focus), which will be discussed later in this literature review.

BOUNDARY CONDITIONS OF STEREOTYPE THREAT

Implicit theories of ability

How one views ability may determine whether or not they are susceptible to threat. Some studies have shown that people who believe that intellectual abilities are innate and fixed (entity beliefs), rather than malleable and able to be developed (incremental beliefs), are more vulnerable to negative stereotypes (Dweck, 1999; Shih, Pittinsky, Ho, 2011). It has also been suggested that those with entity beliefs are also more susceptible to positive stereotypes than those with incremental beliefs (Mendoza-Denton et al., 2008; Shih, Pittinsky, Ho, 2011).

Task framing & difficulty

Task difficulty increases the likelihood of being threatened by a situational cue as it raises the concern that any struggles with the task might actually mean that the negative

stereotype is true of the individual (Nguyen & Ryan, 2008; Steele and Aronson, 1995; Steele et al., 2002). Similarly, if a test is presented as diagnostic of an ability for which one's identity group is negatively stereotyped, it increases the likelihood of threat. In Steele and Aronson's (1995) seminal piece, stereotype threat was only invoked when the task was framed as a diagnostic of intelligence.

Activation of stereotype

There is evidence to suggest that how a stereotype is made known affects whether or not it threatens performance. Levy (1996) proposed that implicit (but not explicit) cues affect the subconscious psychological mechanisms which would directly affect performance under threat (Nguyen & Ryan, 2008). The effects of stereotype threat in the literature have differed based on whether these identities (and their corresponding stereotypes) are implicitly or explicitly cued (Nguyen & Ryan, 2008). Implicit cues, such as marking one's gender before taking a math test, have shown a stronger negative effect on performance (Bargh, 1996; Nguyen & Ryan, 2008), while explicit cues may cause a boost in performance (Kray, Thompson, & Gallinsky, 2001; McFarland, Kemp, et al., 2003; Nguyen & Ryan, 2008). This boost in performance is actually inconsistent with stereotype threat theory and suggests that explicit manipulations might actually be invoking another group of processes, known as stereotype priming effects.

Stereotype priming effects are a result of stereotype activation and actually share some of the same aspects as stereotype threat, yet remain an entirely separate domain and research has only just recently begun to clarify the differences between the two (Marx, 2011). When a negative stereotype is explicitly primed, it can often result in one adopting the opposite behavior (Spears et al., 2004). The idea that much of the research has actually been studying priming effects on female math performance is supported by the

results of a meta-analysis which showed that over ten years of studies, stereotype threat effects on female math performance were much weaker when stereotypes were made explicit (Nguyen & Ryan). This could be because that in some studies, when a stereotype was made blatant, it actually reversed the direction of the effects (i.e., women performed better under explicit threat; Kray, Thompson, & Galinsky, 2001). Furthermore, it could be argued that any type of explicit stereotype threat manipulation would not lead to a valid study of threat – when a female student sits down to take the GRE, there is no mention on the test of any type of gender differences. Further research is needed to determine if there is a difference between implicit and explicit stereotype priming conditions and how they relate to the experience of threat.

Self-relevance

According to the theory of stereotype threat, for threat to occur, it must be self-relevant (Steele and Aronson, 1995). In other words, as stereotype threat is caused when one is trying to not confirm a stereotype about an aspect of themself, this "self-threat" only occurs when one shares the identity of the stereotyped group. For example, for a female who does not identify with a mathematics identity, exposure to the negative stereotype that females have low math ability will not impair her performance on a mathematics test. This is the major difference between stereotype threat and stereotype priming effects.

Stereotype priming effects require activation of a stereotyped identity, but they do not require that the stereotype be self-relevant (Marx, Stapel, & Muller, 2005). For example, one study found that when college students were primed with traits about the elderly they walked more slowly down a hallway, compared to a control group (Bargh et al., 2001; Marx, 2011). In another study, students performed better on a test of general

knowledge when they were primed with traits related to that of a university professor than when they were primed with the traits of "hooligans" (Dijksterhuis & van Knippenberg, 1998). So how do we determine whether the effects caused by a manipulation are because of stereotype threat instead of stereotype priming? Many stereotype threat studies fail to determine how closely one identifies with the stereotyped domain (e.g., Rydell, McConnell, & Beilock, 2009) or use appropriate comparison groups to rule out priming effects (Shih, Pittinsky, & Ambady, 1999; Keller, 2007). If one does not compare the experiences of both targets and non-targets of threat, it is then difficult to differentiate these studies from showing stereotype threat effects or stereotype priming effects (Marx, 2011).

Furthermore, according to Marx, no research which has used priming procedures as a way to activate stereotype threat has included the measure of the pressure to not confirm that is felt by threat targets (Marx, 2011). It has only been assumed that stereotype threat was activated based on decrements in performance. To ensure that a complete and valid model of stereotype threat is developed, it is important to know if and when threat is activated (rather than when a stereotyped behavior is primed). It should be noted that several pieces of literature that have attempted to study this have recently been retracted due to falsified data by Dr. Diederik Stapel, unknown to his coauthors (e.g., Marx & Stapel, 2006). Thus this remains an area for further investigation.

STEREOTYPE BOOST THEORY

While anyone who identifies with a stereotyped domain is at risk of being affected by stereotype threat, it has been suggested that having multiple stereotyped identities might compound this effect (Gonzales, Blanton, & Williams, 2002). However, that may depend on whether the stereotypes are positive or negative. An implicitly

invoked, positively stereotyped identity might actually lead to a boost in performance (Shih, Pittinsky, & Ambady, 1999). As detailed by Shih, Pittinsky, and Ho (2013), much research is still needed to understand not only the effects of stereotype boosts, but the mechanisms underlying them.

These types of positive effects on performance should not be confused with those of stereotype lift. Stereotype boost occurs when a group performs better due to the activation of a positive stereotype about an aspect of their identity, or in other words, a target of a stereotype performs better. Stereotype lift occurs when a non-target group performs better when a negative stereotype is activated about a target group (Walton & Cohen, 2003). For example, in a situation where male and female students are taking a math test and the test is known to produce gender differences, the females will tend to underperform compared to a control group, while the males will perform better. A hypothesis for why this increase in performance exists is that being able to look down on another group leads to an increase in self-efficacy and a decrease in self-doubt (Walton & Cohen, 2003; Shih, Pittinsky, & Ho, 2013). Similar to stereotype threat, a stereotype boost occurs due to situational cues in the environment which make an identity salient or not. Just as in stereotype threat research, how a stereotype is invoked may make a difference.

Shih, Pittinsky, and Ambady (1999) conducted two experiments which studied implicit stereotype threat effects on performance on mathematics tests when different social identities were made salient. Using a population of Asian American women, they looked at how performance differed when a negative stereotype was activated (females have inferior quantitative ability as compared to men) versus a positive stereotype (Asians have superior quantitative ability as compared to other ethnicities). The authors manipulated stereotype relevance by asking the participants to fill out one of three types

of questionnaires: the first asked them to indicate their gender and then answer questions related to their gender identity, the second asked them to indicate their ethnicity and then answer questions about their ethnic identity, while the third did not have to indicate either gender or ethnicity and then answered questions which related to neither identity. They found that the participant's accuracy (number correct divided by number attempted) increased in relation to the control group when the Asian identity was made salient, while accuracy decreased in relation to the control group when the female identity was activated.

Cheryan and Bodenhausen (2000) built off this study, but used manipulations which they considered to be more likely to increase identity salience. They also used a population of Asian American females, and had them complete a series of identity related questions before taking a difficult math test. Rather than just having general questions about either their gender or ethnic identity (as done by Shih et al.), the authors used a modified version of the Collective Self-Esteem Scale (Luthanen & Crocker, 1992), which asked participants to indicate to what degree they agreed with statements, such as "I am a worthy member of the racial group that I belong to," and "Overall, my race is considered good by others." Under the condition where ethnic identity was made more salient, Asian students performed significantly worse. However, when gender was made more salient, the participants' accuracy in solving problems was not significantly different from the control group. The participants in the ethnicity salient condition were significantly more likely than participants in the control group to report that they had difficulty concentrating, and the authors in fact found that the impact of ethnicity focus on quantitative performance was partially mediated through the identity salience effect on concentration. It should be noted that as no statements were explicitly made about

expected performance on the task by different identity groups, this could still be categorized as an implicit stereotype threat manipulation.

In 2009, Rydell, McConnell, and Beilock examined how explicitly activating multiple identities, specifically positive ones, could buffer the negative effects of stereotype threat. Two key aspects of social identity theory (Tajfel & Turner, 1986) informed their study: (1) humans want to have a positive image of themselves, and (2) when confronted with a negative stereotype about a group they identify with, one possible reaction is to leave that group (by suppressing that identity) and increasing their identification with a more positively viewed group. The authors found that when reminded of a negative stereotype about female math ability, female college students performed worse on a mathematics test than a control group as well as a group who was primed with the positive stereotype that college students had high math ability. However, when the females were exposed to both the positive college stereotype and the negative female stereotype, they showed lower gender identity accessibility and performed better on the mathematics test as compared to those just exposed to the negative stereotype. The authors argued that, from a social identity perspective, females had left the negatively stereotyped group (suppressing their female identity) and aligned themselves with the more positive college student identity. While social identity theory (Tajfel & Turner, 1986) may explain why the positive identity was chosen over the negative, both of these identities were invoked explicitly, and thus the results may be more associated with stereotype priming effects, rather than stereotype threat effects. This is not to say that stereotype threat effects cannot be invoked at the same time, but as this study failed to use non-target comparison groups or evaluate the degree to which the females identified with either a math or college identity, it is unclear which effects were invoked here. Additionally, as other research has shown that invoking a positive identity does not

always lead to performance boosts, perhaps there were specific characteristics associated with each of the group identities (females and college students) that could actually better explain this effect. Maybe what matters more is how a positive identity is invoked as well as the characteristics that are associated with it, such as regulatory focus.

SELF-DISCREPANCY THEORY & REGULATORY FOCUS

Recent research has looked at regulatory focus as having a possible relationship with stereotype threat and boost effects; however there is not agreement in the literature about its role. Regulatory focus (Higgins, 1997) is a theory of self-regulation that developed out of a motivational framework known as self-discrepancy theory (Higgins, 1987). As this study seeks to determine the role of regulatory focus in stereotype threat effects, regulatory focus and its foundational framework of self-discrepancy will be discussed in detail.

Self-discrepancy theory builds on a historical tradition in psychology of looking at how people experience discomfort when they hold contradictory or incompatible beliefs of the self (Higgins, 1987, 1989, 1996; Spoor, 2006). Specifically, Higgins created a framework whereby we could understand how the self and conflicting ideas about the self are related to affect. He proposed that self-state representations are manifestations of two cognitive dimensions: domains of the self and standpoints of the self. In other words, we have a version of our current selves and a version of what we (or others) believe we want to (or should) be, and the kinds of differences between these two versions of self predict the emotions we will experience. There are three self domains: the *actual self*, which is the self-representation of the attributes one feels one actually possesses; the *ideal self*, which is a representation of the attributes one or others would ideally like to possess; and the *ought self*, which is a representation of the attributes one or others feel

one should possess. Your ideal self is a representation of your goals, dreams, and aspirations; your ought self is a representation of your responsibilities, obligations, or sense of duty. In addition, these self-representations vary in whether they are from the standpoint of the self or of significant others (Higgins, 1987; Spoor, 2006) – whether it's your own belief or the beliefs of a significant other about you. When the domains of self and standpoints of the self are combined, this results in six separate self-state representations: actual/own, actual/other, ideal/own, ideal/other, ought/own, and ought/other (Higgins, 1987). Higgins further separates the self-states by categorizing actual/own and actual/other as what makes up one's *self-concept* (Wylie, 1979; as quoted in Higgins, 1987), while the remaining self-states are thought of as *self-guides* (Higgins, Strauman, & Klein, 1986; as quoted in Higgins, 1987), or standards to which one compares themselves.

Self-discrepancy theory proposes that we are motivated to have our self-concept match self-guides that are personally relevant, and that the degree to which they either match or differ results in different emotional consequences (Higgins, 1987; Spoor, 2006). Matches between the actual self and a self-guide result in positive emotions, such as happiness, satisfaction, or quiescence. Differences between these however, result in a negative psychological situation characterized by two types of emotional states that focus on either the absence of actual or expected positive outcomes, or the presence of actual or expected negative outcomes. Absence of positive outcomes is associated with dejection-related emotions, such as disappointment and sadness, while the presence of negative outcomes is associated with agitation-related outcomes, such as fear or anxiety. Higgins proposed that dejection-related emotions are experienced when there is a discrepancy between actual/own and ideal/own, or between actual/own and ideal/other. Agitation-

related emotions are a result of a discrepancy between actual/own and ought/other, or between actual/own and ought/own.

The magnitude of emotion we experience related to self-discrepancies is determined by the availability and accessibility of these discrepancies. Availability refers to whether or not a self-discrepancy is actually present (Higgins, 1987). The greater the divergence of attributes between the actual self and the self-guide, the more available the self-discrepancy becomes. Accessibility refers to how readily a self-discrepancy is used in information processing and is related to how recently it has been activated, how frequently it has been activated, as well as how related it is to a stimulus event. As an example of the recency of activation, exposure to a priming manipulation (where certain trait labels were made known) in a prior "unrelated" task, has been shown to increase the likelihood that a person's behaviors on a subsequent task would be interpreted in terms of those constructs which were activated by the trait labels (Higgins, Rholes, & Jones, 1977; Srull & Wyer, 1979; Bargh & Pietromonaco, 1982; as quoted in Higgins, 1987). Research has also shown that the more frequently a construct is activated, the more likely one will use the construct to interpret social events (Higgins, Bargh, & Lombardi, 1985; Srull & Wyer, 1979; as quoted in Higgins, 1987). These effects are somewhat analogous to the idea of stereotype threat effects. Continuously facing a negative stereotype about either an ideal or ought self (self-discrepancy) could lead to a higher chance of invoking the negative emotions each time one is confronted with a task that is related to the negative stereotype. This further supports the idea that, in an effort to avoid these negative emotions, one would distance themselves from this identity (or self-guide) entirely. Lastly, the likelihood a construct will be activated depends on how much it is relevant to an event (Higgins, Rholes, & Jones, 1977; as quoted in Higgins, 1987). In

terms of self-discrepancy theory, this means that an unambiguously positive event will not activate the negative psychological state associated with a self-discrepancy.

While self-discrepancy theory provides a framework to help explain why we are motivated to reduce discrepancies between our actual self and our ideal/ought selves, regulatory focus theory describes the strategies we employ to reach this desired end state (Higgins, 1997). Based on an evolutionary perspective of humans' innate desire to approach pleasure and to avoid pain, this theory assumes that this hedonic principle operates differently for different needs, such as nurturance and security. Higgins proposed that we have two independent self-regulatory orientations that attend to these two survival needs, otherwise known as a promotion or prevention focus. A promotion focus is induced when regulatory concerns are related to reducing discrepancies between the actual self and an ideal self (nurturance), while a prevention focus is induced when concerns are related to reducing discrepancies between the actual self and the ought self (security; Higgins, 2001; Seibt & Förster, 2004). Under a promotion focus, individuals are more concerned with the presence or absence of positive outcomes and experience emotions that range from cheerfulness to dejection, based on how closely the actual self matches the ideal self. Individuals under a prevention focus, however, are more concerned with the presence or absence of losses, and experience emotions ranging from quiescence to agitation or anxiety (Spoor, 2006). It should be noted that while people may have one chronic regulatory focus, a different focus can be induced momentarily by making positive or negative outcomes salient (Roney, Higgins, & Shah, 1995; Shah, Higgins, & Friedman, 1998; Keller & Bless, 2006), activating knowledge structures related to either nurturance or security needs (Friedman & Förster, 2001; Keller & Bless, 2006), priming with either ideals or oughts (Freitas, Liberman, & Higgins, 2002; Higgins, Bond, Klein, & Strauman, 1986; Keller & Bless, 2006), or by activating motor actions

related to either approach or avoidance (Förster, Higgins, Idson, 1998; Friedman & Förster, 2000; Keller & Bless, 2006).

When the strategies used for attaining a goal complement the performer's regulatory focus, motivation and performance are enhanced (Avnet & Higgins, 2003; Higgins, 2000; Shah et al., 1998). This type of compatibility between "dispositions, task incentives, and means of goal attainment" (Shah et al., 1998) and either the chronic or situationally-induced regulatory focus is known as *regulatory fit* (Keller & Bless, 2006). The relationship between regulatory focus and reward structure is particularly relevant to the current research study. As those under a promotion focus are more concerned with the presence (or absence) of positive outcomes, they are more aware of the presence of rewards. Thus, when a person with a promotion focus is completing a task where either the strategies used or the rewards given focus on gains or non-gains, they experience a regulatory fit. Likewise, someone with a prevention focus is more concerned with losses and will thus experience regulatory fit when completing a task where the nature is focused on losses or non-losses (Grimm et al., 2009; Higgins et al., 1997; Higgins, 2001; Keller & Bless, 2006; Maddox et al., 2006; Shah et al., 1998).

A real life example of this is if one were trying to get another individual to stop smoking. For a smoker who is normally a promotion-focused individual, one would use messages concerning societal approval of non-smokers. This person is more motivated by obtaining an ideal. However, for a prevention-focused smoker, messages should be about the societal disapproval of smokers. This person is more concerned with responsibility and becoming the person they ought to be. So while both have the end goal of not smoking, they respond to different messages and rewards and use different strategies to reach those goals.

REGULATORY FOCUS AND STEREOTYPE THREAT

As stated previously, recent research has begun to look at the possible relationship between stereotype threat and regulatory focus, though there is not yet a consensus about its role. Similar to the vigilance phase proposed in stereotype threat, a prevention focus is associated with a risk-aversive state and an attention to not making errors. While some researchers have argued that the presence of a self-relevant stereotype threat causes one to invoke a prevention focus (Seibt and Förster, 2004; Grimm et al., 2009), others propose that stereotype threats are a function of an already situationally-induced regulatory state (Keller, 2007; Keller, 2012). Thus there is need for more research to help tease out this relationship.

In 2004, Seibt and Förster proposed that regulatory focus influences performance under stereotype threat – that when confronted with a self-relevant stereotype, one becomes vigilant to avoid a negative outcome, such as confirming the stereotype, and is thus under a prevention focus. In other words, they argued that the negative stereotype highlighted a discrepancy between the actual self and an ought self. They conducted a series of five studies to test whether a negative stereotype led to better recall of avoidance-related information (and positive stereotypes to approach-related information), whether negative stereotypes led to decreased speed of performance (and positive stereotypes to increased performance), and whether negative stereotypes enhance analytic thinking (while positive stereotypes inhibit it). In the first of five studies, participants were asked to proofread a text about the life of a student which contained ten events where an approach self-regulatory strategy was exemplified and ten events that represented an avoidance self-regulatory strategy. Before completing the proofreading task, participants (none of whom were psychology majors) were randomly assigned to one of two priming conditions – a negative condition which stated that psychology

students usually performed well on the task, while other majors tended to perform poorly, or a positive stereotype condition which stated the opposite to be true. After the task, the participants were asked how many parts of the text they could remember. Under the negative stereotype threat condition, participants were more likely to recall avoidance statements, whereas a positive stereotype led to better recall of approach statements. The second study implicitly invoked a stereotype related to men having worse verbal abilities than women by stating that the verbal skill task they were to complete was to measure gender differences between men and women, and participants had to indicate their gender before completing the task. Under the threat condition, participants completed a test that was labeled as a "Verbal Ability Test" (Seibt & Forster, 2004, pg. 43) or a test with no title. The authors found that under the stereotyped condition, men performed significantly slower (indicating a concern with accuracy and a prevention focus) and women were significantly less accurate (indicating a type of risky behavior associated with a promotion focus) compared to the control condition participants. The third experiment tested the speed and accuracy of connecting a series of numbered dots under a positive stereotype, negative stereotype, or control condition. The threat conditions were manipulated in the same way as the first study (psychology vs. non-psychology). They found that the positive stereotype condition was the fastest, followed by the control, and then the negative stereotype condition. The opposite trend was observed for accuracy. The last two studies used the same explicit manipulation as the first study and looked at how positive and negative stereotypes could affect creativity and analytical thinking. In both studies they found that a negative stereotype led to greater scores on measures of analytical thinking, while participants exposed to an explicit positive stereotype performed better on measures of creativity. They proposed that the reason for these differences is that the negative stereotype activated a vigilant state that increased

accuracy, reduced creativity, and improved analytical thinking. Positive stereotypes on the other hand, led to more risky and explorative processing, thus increasing speed and creativity while decreasing analytical thinking. It should be noted though, that only the second experiment implicitly invoked a negatively stereotyped identity.

Keller (2007) on the other hand, argued that stereotype threat effects are caused by the adopted regulatory focus. Keller randomly assigned 59 male participants to one of two manipulations: in the first, participants were told that they would gain points for correct answers, not lose points for incorrect or missing responses, and that a good strategy to use was to solve as many questions as possible (promotion focus); the remaining participants were instructed that they would gain points for correct responses but lose points for incorrect or missing responses, and that a good strategy would be to focus on making as few errors as possible (prevention). The participants then read either a statement that indicated that the following two verbal tests were shown to produce gender differences (threat) or one that indicated the test was gender neutral (control). In contrast to Seibt and Förster's study, participants performed worse under threat when they were in a prevention focus, and it was significantly different from those under a promotion focus. There was no significant difference between regulatory focus conditions under the neutral threat condition. Keller proposed that these results did not necessarily contradict Seibt and Förster's findings, but that regulatory focus as related to threat was context-specific as regulatory theory itself did not reflect a valance dimension of self-regulation. It could be argued however, that these particular gains and losses manipulations are not consistent with the regulatory focus framework. Failure in a prevention focus is not achieving a minimal goal (Idson, Liberman, & Higgins, 2000), while failure in a promotion focus is not achieving a maximal goal. The reward structures in this study do not clearly follow the idea of a gains/non-gains versus a loss/non-loss

concept of regulatory focus. Also, the fact that the regulatory focus strategies were presented rather than implicitly invoked could be why these results differ. Keller argues that perhaps a negative stereotype turns into a challenge when someone is under a promotion focus rather than a prevention focus. If this is the case though, then the effects would more closely resemble those of explicit stereotype threat studies.

Another study published in 2009 (Grimm et al.) built off of Seibt and Förster's work and proposed that stereotype threat was actually a misalignment between regulatory focus and reward structure. Grimm et al. argued that under threat, a stigmatized group would revert to a prevention state. Therefore, under traditional testing conditions where one gains points for correct responses, their motivational state would be mismatched with the reward structure. In one study, both female and male participants were told that they would be taking a math test which was shown to be diagnostic of math ability, but there was no mention if there were gender differences. Then the participants were randomly assigned to either a prevention or promotion reward structure and asked to complete a series of GRE math items. In the promotion reward structure, participants were told that they would gain 2 points for each correct answer, 0 points for any incorrect response, and that their goal was to earn 36 points (which was equivalent to a 90% correct response rate). Participants in the prevention reward structure would lose 1 point for each correct response, but lose 3 points for each incorrect response. Their goal was to also reach about a 90% correct response rate, by not losing more than 24 points. The results showed that females under threat performed better under a losses structure, while males performed better under a gains structure. There was no significant difference between performance of women in the losses condition and males in the gains condition. In a second set of experiments, explicit stereotypes about performance on a classification task were used to determine if regulatory match promotes cognitive flexibility. In one experiment,

participants were told that women performed better on the classification task they were about to complete, while the second study stated that men performed better. The participants were then assigned to a reward structure that either emphasized gains or losses. Results showed that in the first study (stereotype: women perform best), men in the loss condition and women in the gains condition exceeded the criterion sooner. In the second study (stereotype: men perform best), only a significant difference between men was found – males in the gains condition performed better than males in the loss. These findings help support the model argued by Seibt and Förster, however it could be argued that the second part of the study was actually looking at stereotype priming effects.

Stahl, Van Laar, and Ellemers (2012) suggested that there were boundary conditions of the relationship between regulatory focus and stereotype threat. In three experiments on a group of social science students, the authors found that stereotype threat enhanced cognitive control under a prevention focus but not when a promotion focus was invoked, however this effect diminished after a time. In the first study, participants were exposed to a negative stereotype or did not receive any information about performance differences before completing a simplified Stroop color-naming task. They found that stereotype threat significantly improved immediate performance. The authors used the same procedure in the second experiment, but after the threat manipulation, participants were asked to write down what they would ideally like to achieve (promotion focus), what they ought to achieve in their studies (prevention focus), or were asked nothing (control). Stereotype threat was shown to have a positive effect on cognitive control when no regulatory focus was induced as well as when a prevention focus was induced, with a prevention focus showing the best performance. There was no effect on a promotion focus condition though. In the final study, the authors had female participants complete a short math test immediately following the stereotype threat manipulation or after a delay.

It was found that stereotype threat improved performance on a math test under a prevention focus if the test immediately followed the threat manipulation, but when those under a prevention focus took a test under threat after a delay, they actually performed worse. The authors argued that continued regulation of negative thoughts and emotions over time leads to cognitive exhaustion. As with other research though, this study failed to assess domain identification, use non-targets of threat, or invoke implicit stereotypes, so it is again hard to determine if these could in fact be a study of priming effects. It also, as in Keller's (2007) study, explicitly invokes a regulatory focus.

REGULATORY FOCUS AND IDENTITY

In light of the research on regulatory focus and stereotype threat, how might we view studies which look at differences in performance based on either positive or negative identities (Shih, Pittinsky, and Ambady, 1999; Cheryan & Bodenhausen, 2000; Rydell, McConnell, & Beilock, 2009)? The literature supports the idea that different identities can have different regulatory foci (Lee, Aaker, & Gardner, 2000) and that a group regulatory focus can develop over time based on a reward structure associated with a certain group (Levine et al., 2000; Faddegon, Scheepers, & Ellemers, 2008). When an identity is made more salient, could a certain regulatory focus be made more salient as well?

Faddegon, Scheepers, and Ellemers (2008) showed that a collective regulatory focus could be induced by showing participants group mottos which were supposedly chosen by other group members, which expressed either a prevention or promotion focus. They based their research on social identity theory (Tajfel & Turner, 1979) and self-categorization theory (Turner et al., 1987). They argued that individual regulatory focus can be induced through the process of self-categorization to match what is considered the

group norm focus. In ambiguous situations, where one is unsure of what strategy to use, people tend to look for what is typical of their group and judge their behavior based on that (Faddegon, Scheepers, & Ellemers, 2008; Oakes, Haslam, & Turner, 1994; Turner, Oakes, Haslam, & McGarty, 1994). What happens when a person is confronted with a situation where they might be unfairly judged due to one part of their identity which is negatively stereotyped? Would they adopt the stereotypical regulatory focus of the identity which is most salient?

Levine et al. (2000) showed that individual regulatory strategies could converge over time to match the reward structure of a group, becoming either prevention focused or promotion focused depending on whether outcomes were framed as gains/non-gains or losses/non-losses (Faddegon, Scheepers, & Ellemers, 2008). As academics in the United States focus largely on outcomes which are based on a gains reward structure, it could be argued that as one develops an academic identity over time in this reward structure, one would associate a promotion focus with this group identity. Could this explain why Rydell, McConnell, & Beilock (2009) found an increase in performance on a gains-based task when a college identity was made salient? Based on social identity theory, the participants would have suppressed the negatively stereotyped identity (being female) and invoked the college identity and perhaps a promotion regulatory focus as well. But what about when a positive identity leads to a decrease in performance, as with Cheryan and Bodenhausen's (2000) study? When an Asian identity which was associated with high math performance was made more salient, female performance actually suffered on a gains-based task.

In a series of five studies, Lee, Aaker, and Gardner (2000) showed that regulatory focus strategies are invoked to match the accessible self-construal. Similar to the idea of the social self (Tajfel & Turner, 1987), self-construals are related to how we define

ourselves in relation to others (Markus & Kitayama, 1991; Brewer & Gardner, 1996). An independent self-construal, most commonly associated with Western culture, is an identity that defines the self in terms of characteristics and attributes which are unique and different from others. An interdependent self-construal is more concerned with the individual in the context of the group membership and is more commonly associated with Eastern and Latin American cultures (Lee, Aaker, & Gardner, 2000). Findings from these five studies supported the hypothesis that those with an interdependent self-construal were more likely to have a prevention focus, and those with an independent self-construal were more likely to have a promotion focus. Using these findings, one could argue that when Cheryan and Bodenhausen (2000) invoked the positive Asian identity, they simultaneously invoked a regulatory focus associated with an interdependent self-construal (prevention focus). This could explain why the participants failed to perform better on a task that emphasized gains. There is a need for more research to determine if group regulatory focus could explain differences in the effects of positive stereotypes on performance.

PILOT STUDY

In a first step to address some of the limitations of previous work, a pilot study was conducted in an attempt to replicate the findings of Rydell, McConnell, & Beilock (2009), while at the same time investigate the role of regulatory focus. One hundred thirty-seven participants were randomly assigned to one of three threat conditions: control, negative stereotype (females have low math ability), and a negative and positive stereotype (females have low math ability, but college students have high math ability). As in the previous study, these stereotypes were explicitly primed. Following the threat manipulation, participants were then randomly assigned to either a gains/no-gains reward

structure or a loss/no-losses structure similar to the one used in Grimm et al.'s (2009) study. The study failed to replicate the findings of either work. Consistent with the research on explicitly primed stereotypes, female performance showed a general trend that suggested improved performance over the neutral threat when confronted with a negative stereotype, though this was not significant. Males performed significantly worse when the negative stereotype about females was explicitly primed. Across all threat conditions, males performed best in a reward structure that emphasized minimizing losses, while females performed best when they were trying to maximize gains. Although the female findings were not significant, given their general trend, the results for the males, and the reverse of regulatory fit, this suggests that the manipulation used by Rydell, McConnell, and Beilock may have invoked stereotype priming effects and not stereotype threat effects. Thus, there is a need to build off of this study by examining how results may differ when threats are invoked implicitly, which is a more consistent and valid study of stereotype threat.

GENERAL SUMMARY & CURRENT STUDY

While stereotype threat research has exploded over the last couple of decades, there seems to be an inconsistency in not only the findings, but of how stereotype threat is actually defined and invoked. In an effort to differentiate stereotype threat research from stereotype priming research, future studies need to ensure that non-target groups and measures of self-threat are included. Furthermore, as there are inconsistent findings in the role of positive stereotypes as buffers against threat, more research is needed to determine if underlying characteristics of the identities could explain the differential results. As different identities can be related to different regulatory foci, which have been

recently identified as being related to stereotype threat, research is needed in the intersection of these three areas of the literature.

The current study sought to address these methodological limitations of previous research as well as help add to the growing body of literature on both multiple identities and regulatory focus as related to stereotype threat. It did this by trying to use regulatory fit to explain why some stereotypes might lead to increased performance under threat. While previous research has studied various couplings of the three constructs, this study is the first to examine the possible interrelationships of all three.

Chapter 3: Methodology

Statement of Purpose

The purpose of this study was to examine how invoking different facets of one's multiple identities leads to differential performance under stereotype threat. It did this by examining the role of regulatory focus and how it may explain why some stereotypes lead to better performance under threat while others depress performance. To study these effects, this study used the commonly believed negative stereotype that women have inferior math abilities compared to men. A positive stereotype is that college students, especially those at elite institutions, tend to have higher math ability. This study manipulated the activation of these stereotypes by making them more or less salient under a potentially threatening situation, that of taking a diagnostic test of math ability. Regulatory focus and its relationship to identity and subsequent performance under threat were examined through the manipulation of reward structures.

Participants

A total of 315 participants were recruited from the Department of Educational Psychology subject pool at the University of Texas at Austin. As part of the selection criteria, potential participants were asked to rate the following statement on a 5-point scale (strongly agree=1 to strongly disagree=5): I am good at math and it is important to me that I am good at math (modified from Spencer, Steele, & Quinn, 1999; Markus, 1977). Participants who responded with either a 1 or 2 were recruited to fulfill the math-identified quota, while females who responded with a 4 or 5 were recruited to fulfill the non-math-identified quota. This was done to ensure that the math domain identity (and possible threat situation related to testing math ability) was self-relevant to enough of the participants, while still allowing for the inclusion of non-targets. Approval was obtained

from the university's Institutional Review Board (IRB) prior to conducting the study. Participants did not receive any financial compensation for completing the study; however they received course credit when they completed the measurement packet. The approved IRB document is in Appendix A.

INSTRUMENTATION

Scholastic Aptitude Test (SAT)

As a measure of previous performance on standardized tests which was used to determine within-group differences, the students were asked to provide their score on the mathematics portion of the SAT. As in Steele and Aronson's original study (1995), this was used as a covariate.

Gender, & College Identity

Gender and college identity were both measured as well as invoked by asking a series of questions related to how strongly one associates with that aspect of their identity. There was a subset of twelve items taken from the Collective Self-Esteem Scale (Luhtanen & Crocker, 1989; Ethier & Deaux, 1990; Cheryan & Bodenhausen, 2000). Example items for gender identity include: "Overall, my gender is considered good by others," and "I am a worthy member of the gender group I belong to" (Cheryan & Bodenhausen, 2000). This measure has coefficient alphas of .75, .72, .88, and .84 for the Membership, Private, Public, and Identity subscales, respectively. These were reworded for college identity in order to make that identity salient. (See Appendix B for specific items on Gender and College identity). The college identity also contained four additional questions about group membership which did not apply to gender as they are related to choice (Ethier & Deaux, 1990). Those in the control condition did not complete this section.

Chronic Regulatory Focus

Prior to the stereotype threat manipulation, participants completed the Regulatory Focus Questionnaire (RFQ: Higgins et al., 2001; Grimm et al., 2009) to determine their chronic regulatory focus. The RFQ consists of 11 Likert scale items which asked how frequently promotion or prevention type events have occurred in your life. An example item, scored from a range of "1-never or seldom" to "5-very often" is: "When it comes to achieving things that are important to me, I find that I don't perform as well as I ideally would like to do." A score was calculated by response patterns on prevention and promotion items separately, and then by taking the difference. If the resulting value was positive, the participant was classified under a chronic *promotion focus*; if the resulting value was negative, the participant was classified under a chronic *prevention focus*. This measure has good internal reliability for both the Promotion (α=0.73) and Prevention (α=0.80) sub-scales. Chronic regulatory focus was measured to ensure that if regulatory fit does or does not exist, it was due to the invoked regulatory focus rather than the chronic one. For non-targets and control subjects, their chronic regulatory focus should determine their regulatory fit. For those in a threat manipulation, if the invoked regulatory focus is different from their chronic focus, this will be reflected in the regulatory fit.

Graduate Record Examination (GRE) Quantitative Reasoning Items

As much of the previous research on stereotype threat and female math performance has used GRE questions (e.g., Spencer, Steele, & Quinn, 1999; Cheryan & Bodenhausen, 2000), this study continued this procedure and had the subjects complete
25 items from practice GRE exams obtained for the Education Testing Service's website. Comparability to a previous standardized test of scholastic ability (SAT) further supports

the use of the GRE to determine within-group differences. However, as previously noted, this study does not intend to make generalizations towards high stakes testing.

Measure of Threat-Based Concerns

Participants completed items determined to measure how much they were concerned about the threat affecting their performance. These items were on a 7-point Likert scale, ranging from (1) not at all to (7) very much, and asked questions such as: "I thought about the fact that my own performance has an impact on the result of my gender group" and "I was afraid that my poor performance would worsen the result of my gender group" (Marx & Stapel, 2006). These items addressed gender and college identity.

Measure of Regulatory Fit

Regulatory fit was measured by asking a series of questions regarding emotions felt during the test (Keller & Dauenheimer, 2003; Roney et al., 1995). For prevention-related emotions, participants indicated the degree to which they felt tense, nervous, anxious, depressed, uncertain, agitated, calm, self-conscious, quiet, and unconcerned while taking the test. For promotion-related emotions, participants indicated the degree to which they felt disappointed, sad, frustrated, contented, enthusiastic, light-hearted, happy, or balanced (Keller & Dauenheimer, 2003). These items were measured on a 7-point Likert scale, ranging from (1) not at all to (7) very much.

Additional Measures

To ensure effects were not related to general math anxiety, participants completed a math anxiety measure (Chipman, Krantz, & Silver, 1992) consisting of five items on a 5-point Likert scale ranging from (1) strongly agree to (5) strongly disagree. Participants also answered general demographic questions.

EXPERIMENTAL CONDITIONS

This study used a between-subjects design to examine differences on a dependent measure across three levels of a stereotype condition (control, gender, gender/college) and two levels of a reward structure (gains/non-gains and losses/non-losses). The manipulation was conducted during one lab session.

Stereotype Threat Condition

In Rydell, McConnell, and Beilock's (2009) study of multiple identities under threat, subjects were randomly assigned to one of three stereotype threat conditions: 1) a control condition, 2) a negative stereotype (female math performance), and 3) a positive stereotype (college math performance) in addition to a negative stereotype (female math performance). This study used the same groups: *Control*, *Gender*, *and Gender/College*. Those in the *Control* condition completed a series of questions unrelated to their gender, ethnicity, or college identity. They were then instructed that they would take a mathematical test to help validate the questions for future studies. Participants under the *Gender* condition completed a version of the Collective Self-Esteem Scale measure which asked about their gender identity. As stated previously, these items were intended to both measure identity as well as make that identity more salient. They were then instructed that they would complete a test that measured mathematical ability. The last group was asked to complete a series of questions about their identity related to being a student at a prestigious university (*College* condition) in addition to questions about their gender identity. For this last group, the order (gender vs. college) was varied to ensure that there were no recency effects (see Figure 1 for a visual diagram of these manipulations).

Rewards Condition

Based on prior research regarding regulatory fit and stereotype threat (Grimm et al., 2009), this design used two reward structure groups: *Gain/Non-Gain* and *Loss/Non-Loss*. In the *Gain/Non-Gain* condition, participants gained points for correct answers, but in the Loss/Non-Loss condition, they failed to lose points for correct answers. Each group was given a target performance rate (90%, based on either points earned or points failed to lose) and was shown their score after each question.

PROCEDURES

The study was conducted in a university computer lab, where participants completed all measures as well as the GRE questions via an online survey using the Qualtrics survey system. When the subjects arrived at the computer lab, they checked in with the researcher, obtained a Subject ID number, and logged on to the Qualtrics survey. They first completed the measure of chronic regulatory focus and then were randomly assigned to one of the threat conditions (Control, Gender, Gender/College) and completed the associated measures. The participants were then randomly assigned to either the Gain/Non-Gain reward condition or the Loss/Non-Loss. Before beginning the test, participants indicated what they expected their final score to be. The subjects were then given 40 minutes to complete the 25 quantitative items (the same amount of time given to test takers of the actual GRE). Upon completion of the math portion, participants first completed measures of threat-based concerns and regulatory fit before providing demographic information, including gender, major, SAT quantitative score, and ethnicity. After everyone completed the study, the participants were debriefed about the actual purpose of the study, thanked for their time, and given participation credit through the Educational Psychology Department website.

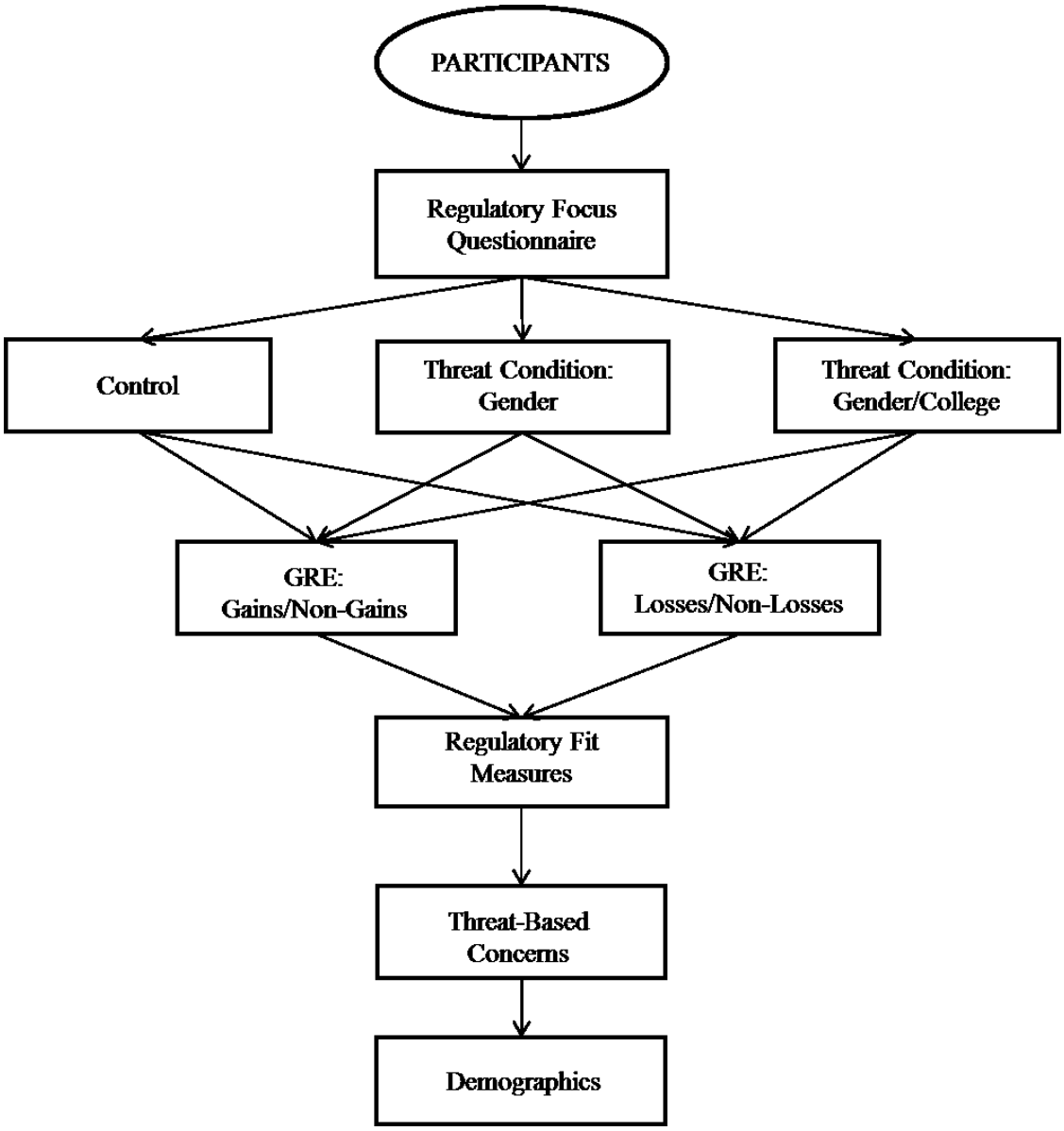


Figure 1. Research Design. Threat is invoked by framing the task as diagnostic of math ability. Identities are invoked through the use of modified versions of the Collective Self-Esteem Scale about gender or college identity.

DATA ANALYSIS

To test the first four hypotheses, a 3x2 Factorial ANCOVA was used to determine between-group differences of manipulations on the GRE task for each gender and

ethnicity, and SAT and RFQ scores were used as covariates. If statistically significant, post-hoc tests were conducted to further test the differences between groups. Additionally, average scores on threat-based concern items across targets versus non-targets of threat were compared using t-tests. Finally, an ANOVA was used to determine differences in regulatory fit by experimental condition, with post hoc tests performed if the F-ratio was statistically significant. A significance level of 0.05 was used for each statistical test.

Research Question 1: *How does the performance of targets (women) and non-targets (men) of stereotype threat vary when the negatively stereotyped identity is salient under stereotype threat?*

Hypothesis 1: Under stereotype threat, target performance will decrease. Threat should have no negative effect on performance of non-targets. In other words, female participants in the Gender threat condition will perform worse than female participants in the Control condition. Males in the Gender threat condition should not perform worse on the GRE questions than males in the Control condition.

Research Question 2: *To what extent can the performance of targets under stereotype threat be modified by the reward structure of the task?*

Hypothesis 2: The performance decrement under threat can be moderated by the reward structure of the task (i.e., women under threat, without the positive identity prime, will perform better in a reward structure that emphasizes losses and non-losses). Therefore, females in the Gender threat condition will perform better on the GRE test in the loss/no-loss reward structure than in the gain/no-gain reward structure.

Research Question 3: *When a negatively stereotyped identity is made salient along with a positively stereotyped identity, to what extent will performance be affected?*

Hypothesis 3: When a negatively stereotyped identity (female) is made salient along with a positively stereotyped identity (college), the college identity will be adopted and thus performance will be higher. Hence, females in the Gender/College condition will perform better on the GRE test than those in the Gender condition.

Research Question 4: *To what extent can the performance of targets with a positively invoked stereotype vary by the reward structure of the task?*

Hypothesis 4: When a positively stereotyped identity (college) with a promotion focus is adopted over a negatively stereotyped identity (female), performance will be best under a promotion focus. It was then hypothesized that females in the Gender/College condition will do better on the GRE test under the gain/no-gain reward structure than those in the loss/no-loss reward structure.

Chapter 4: Results

This chapter describes the statistical analyses used to answer the research questions related to how identity and regulatory focus interact to influence stereotype threat. All analyses were evaluated at a significance level of .05, with results at .10 considered to be marginally significant.

PARTICIPANT CHARACTERISTICS

Of the 276 math-identified participants, 37.7% were male (N=104) and 62.3% were female (N=172). Most of the participants were from the College of Natural Sciences (30.4%), Business (21.7%), Liberal Arts (13.4%), Communication (10.6%), and Education (10.0%). The remaining 13.9% were spread across the other thirteen colleges.

COMPLICATIONS, QUALIFICATIONS, AND LIMITATIONS

Due to availability of test subjects, this study was conducted across two semesters. During the fall, only 15 male subjects were available which caused many of the data collection sections to be entirely female. This is important because the presence of males in the room has been shown to have an effect on female performance – it is more likely to initiate threat. Despite this, data from both semesters were analyzed together. An additional issue encountered was that despite initial screening, many subjects indicated a different level of math identity. For example, some selected as participants for initially reporting high math identity during the inclusionary criteria screening process, reported a much lower identity when asked during the experiment. Therefore it was necessary to collect data, oversampling for math-identified students, during the spring semester to increase power. While a sufficient number of math- identified males and females were present, only 35 non-math identified females completed the study.

In addition, due to IRB restrictions, SAT scores had to be self-reported by the students. If students were unable to locate their scores, they were asked to indicate that in their response. Approximately 80 people were excluded from the primary analysis because they were unable to provide their math SAT score. This meant that only 69 math-identified males and 133 math-identified females could be included in the analyses on GRE performance which used SAT math scores as a covariate.

QUANTITATIVE ANALYSIS

Overview

Baseline data were first compared across relevant groups, such as gender and condition, to support equality of groups regarding chronic regulatory focus and SAT scores. A 2 (Reward: Gains vs. Losses) by 3 (Condition: Control, Gender, Gender & College) ANOVA was conducted for each of these baseline measures for both males and females. Results indicated no significant interaction or main effects for reward structure or condition for either gender on chronic regulatory focus or SAT score (see Tables 3 and 4). Thus these analyses provide evidence that there were no initial group differences on these measures. Table 1 and 2 provides a summary of the descriptive statistics for scores on the SAT and Regulatory Focus Questionnaire (RFQ), and Table 3 shows the results of the ANOVA.

Table 1. Descriptive Statistics by Condition and Reward Structure for RFQ

Gender	Condition	Reward	Mean	SD	N
Male	Control	Gains	7.29	3.46	17
		Losses	4.14	4.91	14
	Gender	Gains	5.67	3.83	15
		Losses	4.12	4.47	17
	Gender/College	Gains	3.61	4.41	23
		Losses	4.50	5.10	18
Female	Control	Gains	3.81	5.60	26
		Losses	3.76	4.02	33
	Gender	Gains	3.76	3.70	29
		Losses	5.60	4.33	30
	Gender/College	Gains	4.29	4.53	28
		Losses	3.65	4.67	26

Table 2. Descriptive Statistics by Condition and Reward Structure for SAT

Gender	Condition	Reward	Mean	SD	N
Male	Control	Gains	708.89	69.36	9
		Losses	696.36	100.43	11
	Gender	Gains	671.82	77.82	11
		Losses	723.00	81.52	10
	Gender/College	Gains	715.88	39.06	17
		Losses	695.45	97.61	11
Female	Control	Gains	648.67	104.06	21
		Losses	671.43	77.01	28
	Gender	Gains	655.65	89.13	23
		Losses	672.00	89.65	20
	Gender/College	Gains	649.61	94.92	23
		Losses	644.44	125.47	18

Table 3. ANOVA Results for Initial Measure of Regulatory Focus

	Source	*df*	*F*	η^2	*p*
Males	Reward	1	2.11	0.02	0.15
	Condition	2	1.25	0.03	0.29
	Reward*Condition	2	1.91	0.04	0.15
	Error	98			
Females	Reward	1	0.32	<0.01	0.57
	Condition	2	0.65	0.01	0.52
	Reward*Condition	2	1.20	0.01	0.31
	Error	166			

Table 4. ANOVA Results for SAT Scores

	Source	*df*	*F*	η^2	*p*
Males	Reward	1	0.10	<0.01	0.75
	Condition	2	0.07	<0.01	0.94
	Reward*Condition	2	1.41	0.04	0.25
	Error	63			
Females	Reward	1	0.45	<0.01	0.50
	Condition	2	0.35	<0.01	0.71
	Reward*Condition	2	0.25	<0.01	0.78
	Error	127			

Additionally, males and females were compared across different facets of gender and college identity using independent t-tests. It was hypothesized that there would be no

difference between genders on any of the measures. Analysis showed that males and females did not significantly differ on measures of college identity. However, this was not the case with gender identity. Males scored significantly higher on items related to both private and public regard for their gender identity. Females however, scored significantly higher on items related to the importance of their gender to their self-worth and general identity. Table 5 shows the results of these analyses.

Table 5. T-Tests of Differences in Identity Measures by Gender

	Males			**Females**		
Identity Sub-Scale	***Mean***	***SD***	***N***	***Mean***	***SD***	***N***
Gender – Private	5.60*	0.53	73	5.39*	0.59	113
Gender – Public	5.11*	0.59	73	4.69*	0.70	113
Gender – Importance	4.17*	0.87	73	4.50*	0.85	111
College – Membership	4.89	0.62	41	5.00	0.67	54
College – Private	5.29	0.66	41	5.49	0.73	53
College – Public	5.43	0.47	40	5.55	0.50	51
College – Importance	4.42	0.81	41	4.66	0.81	54

*Significant at a p=0.05 level

ANCOVA Assumptions and Normality

Prior to conducting the hypothesis tests, a case analysis was conducted to ensure that there were no significant outliers which could affect the outcomes, and that the data did not suggest any serious violations of the ANCOVA assumptions. None of the

observations were shown to have a standardized residual larger than 2.5. Therefore, all of the observations for both genders were included in the analysis.

Independence of Observations

Participants were randomly assigned to conditions (shown in Table 6) through a random number generator within the Qualtrics survey software. Manipulations were individually administered and there was no interaction between participants during the experimental sessions.

Homogeneity of Regression Slopes

An additional assumption required for ANCOVA is that the slopes of the different regression lines should be equivalent, or in other words, that the covariate should not have a significant interaction with the factors. Tests of the relationship between the covariate and all combinations of factors showed no significant differences at the $p=0.05$ level.

Table 6. Representation by Condition

		Control	Gender	Gender & College
Math-Identified				
	Female	Gains: 26 Losses: 33	Gains: 29 Losses: 30	Gains: 28 Losses: 26
	Male	Gains: 17 Losses: 14	Gains: 15 Losses: 17	Gains: 23 Losses: 18
Not Math-Identified				
	Female	Gains: 3 Losses: 5	Gains: 7 Losses: 7	Gains: 6 Losses: 7
	Male	Gains: 2 Losses: 1	Gains: 0 Losses: 0	Gains: 1 Losses: 0

Homogeneity of Variance

Levene's Test of Equality of Error Variances (Table 7) indicated that population cell variances are unequal at the .05 level for females. This test is done to ensure that any group differences from the intervention are not due to initial group differences. Previous analyses on baseline measures showed no significant differences between groups, so analysis proceeded. However, the results should be taken with some caution due to the lack of homoscedasticity.

Table 7. Levene's Test of Equality of Error Variances

Gender	F-Test	Significance
Male	F(5,63) = 0.93	p = 0.48
Female	F(5,127) = 2.32	p = 0.03

Primary Analyses

The next step of the analysis was to examine how groups differed by condition and reward structure, while controlling for SAT scores. A 3x2 Factorial ANCOVA was conducted to test the effects of identity salience and regulatory fit on math performance under stereotype threat. It revealed a main effect of Condition on performance on the math test for females, $F(2,125)=3.22$, $p<0.05$. The interaction between Condition and Reward on performance for females was marginally significant, $F(2,125)=2.30$, $p=0.08$. However, the main effect of Reward on math performance was not significant at a .05 level, $F(1,125)=1.28$, $p=0.23$. Neither main effects nor the interaction were significant for males at a .05 level. Additional pairwise comparisons were conducted to answer the hypotheses. Table 8 summarizes the means (regular and adjusted) and standard deviations of math performance for the six different groups by gender.

Table 8. Group Comparisons on GRE Total Score (General and Adjusted Means)

Gender	Condition	Reward	Mean (SD)	Adj. Mean (SD)	N
Male	Control	Gains	17.59 (4.74)	20.33 (3.32)	9
		Losses	17.79 (4.49)	17.45 (4.68)	11
	Gender	Gains	18.00 (4.36)	18.18 (4.51)	11
		Losses	18.06 (4.19)	19.10 (4.07)	10
	Gender/College	Gains	18.13 (3.85)	18.65 (4.18)	17
		Losses	19.28 (4.08)	19.55 (4.08	11
	Overall	Gains	17.93 (4.21)	18.92 (4.07)	37
		Losses	18.43 (4.20)	18.69 (4.25)	32
Female	Control	Gains	14.77 (5.25)	15.29 (5.43)	37
		Losses	15.88 (5.02)	17.00 (4.13)	32
	Gender	Gains	15.34 (4.11)	15.52 (4.36)	21
		Losses	13.43 (5.75)	13.55 (6.06)	28
	Gender/College	Gains	15.89 (4.95)	16.39 (4.79)	23
		Losses	14.00 (4.80)	15.44 (4.78)	18
	Overall	Gains	15.35 (4.74)	15.75 (4.81)	67
		Losses	14.51 (5.27)	15.53 (5.09)	66

Figures 2 and 3 show performance by Condition and Reward for males and females, respectively.

Figure 2. Math Performance by Condition and Rewards for Males

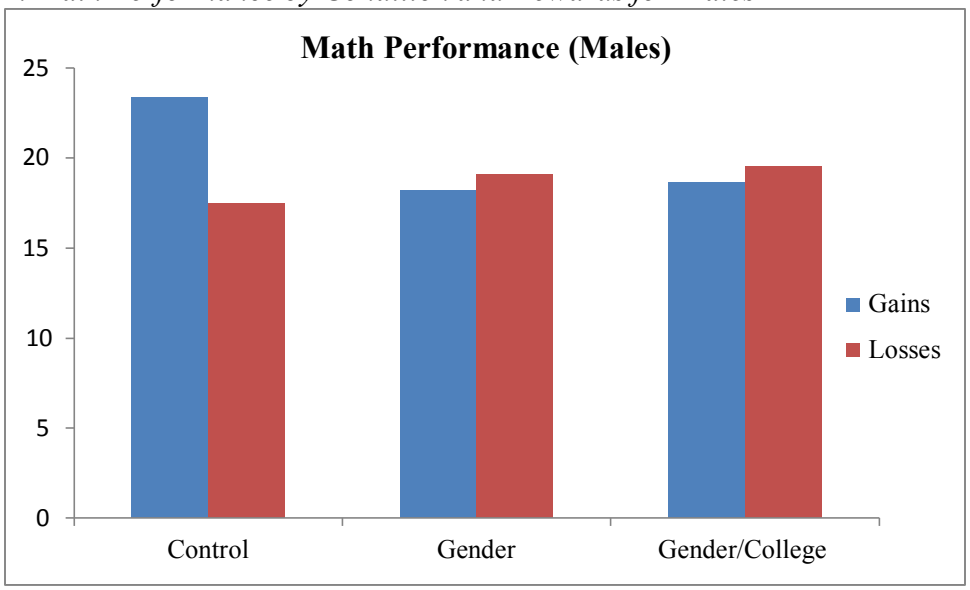


Figure 3. Math Performance by Condition and Rewards for Females

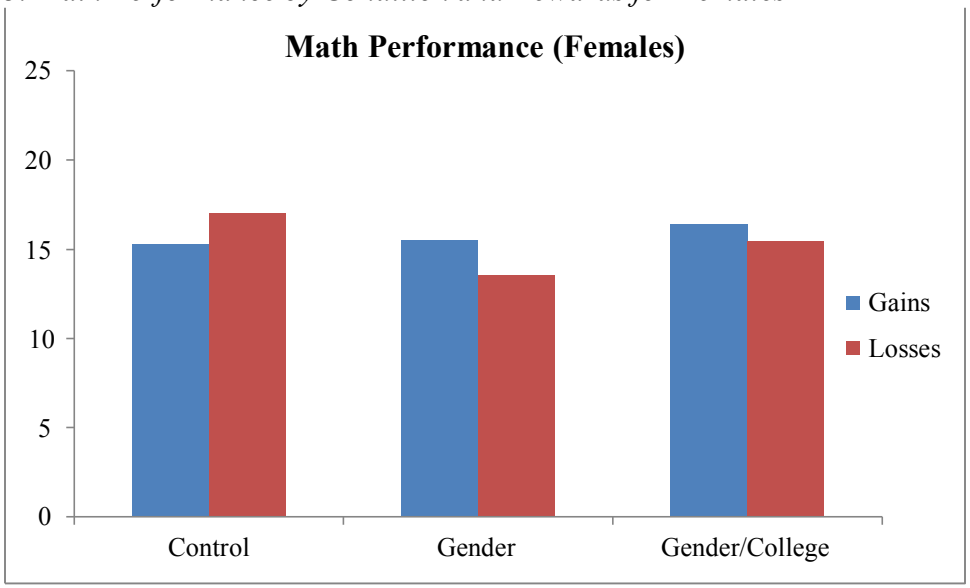


Table 9 below presents the results of the 2x3 Factorial ANCOVA on the GRE test. This provides a test of the main effects of experimental condition and reward structure, as well as the interaction between them. Figure 4 shows performance by condition for each gender.

Table 9. ANCOVA Source Table: GRE Test Performance

Gender	Source	SS	df	MS	F	Sig.
	SAT	411.01	1	77.28	6.90	<0.01
	Condition	0.12	2	0.06	0.01	1.00
Males	Reward	2.53	1	2.53	0.22	0.64
	Interaction	47.09	2	23.55	2.05	0.14
	Error	690.71	60	11.51	-----	
	SAT	1222.19	1	229.66	15.76	<0.01
	Condition	94.09	2	47.04	3.26	0.04
Females	Reward	20.98	1	20.98	1.45	0.23
	Interaction	75.46	2	37.73	2.62	0.08
	Error	1789.10	124	14.43	-----	

Figure 4. GRE Performance by Condition (Males vs. Females)

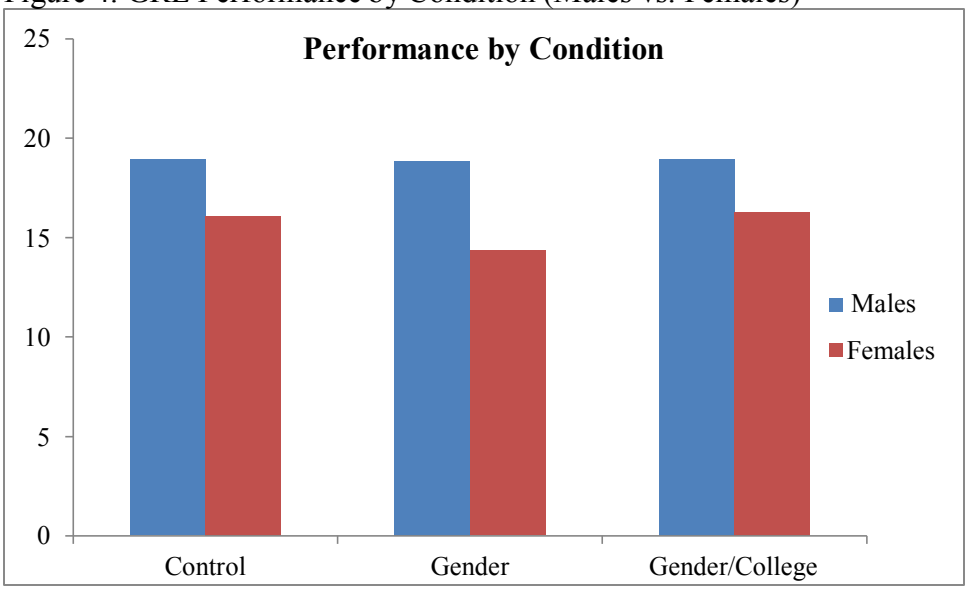


Table 10 presents pairwise ANCOVA comparisons between experimental conditions on GRE test scores. Table 11 shows how performance varied for each gender by condition and reward structure.

Table 10. Pairwise Comparisons on GRE Test by Threat Condition

Gender	Condition (I)	Condition (J)	Mean Difference (I-J)	Std. Error	Sig.
Male	Control	Gender	0.08	0.94	0.94
		Gender/College	-0.02	0.98	0.98
	Gender	Control	-0.08	0.94	0.94
		Gender/College	-0.10	0.92	0.92
	Gender/College	Control	0.02	0.98	0.98
		Gender	0.10	0.92	0.92
Female	Control	Gender	1.71*	0.81	0.04
		Gender/College	-0.22	0.82	0.79
	Gender	Control	-1.71*	0.81	0.04
		Gender/College	-1.93*	0.84	0.02
	Gender/College	Control	0.22	0.82	0.79
		Gender	1.93*	0.84	0.02

*Significant at a p=0.05 level

*Table 11. Condition * Reward Pairwise Comparisons*

Gender	Condition	Reward	Mean	Std. Error
Male	Control	Gains	20.13	1.14
		Losses	17.73	1.03
	Gender	Gains	19.10	1.06
		Losses	18.60	1.12
	Gender/College	Gains	18.12	0.85
		Losses	19.79	1.03
Female	Control	Gains	15.56	0.83
		Losses	16.55	0.72
	Gender	Gains	15.70	0.80
		Losses	13.00	0.86
	Gender/College	Gains	16.63	0.79
		Losses	15.92	0.90

Hypothesis Testing

Research Question 1: *How does the performance of targets (women) and non-targets (men) of stereotype threat vary when the negatively stereotyped identity is salient under stereotype threat?*

It was hypothesized that performance of math-identified females in the Gender threat condition would perform worse on the GRE task than math-identified female participants in the Control condition. It was also hypothesized that math-identified males in the Gender threat condition would not perform worse on the GRE task than math-identified males in the Control condition. The results supported the hypotheses. It was

found that females in the Gender condition performed significantly worse than females in the Control condition by about 1.71 points (out of a possible 25; $p<0.05$), while at the same time males did not perform significantly differently between those conditions. These results are shown in Table 9.

Research Question 2: *To what extent can the performance of targets under stereotype threat be modified by the reward structure of the task?*

It was hypothesized that math-identified females in the Gender threat condition would perform better on the GRE task when in the loss/no-loss reward structure. The data do not support this hypothesis, as there was no significant difference in performance between reward structures (seen in Table 8). Though not significant, females in the Gender condition actually performed about 2.70 points higher under the gains/no-gains reward structure (as seen in Table 10).

Research Question 3: *When a negatively stereotyped identity is made salient along with a positively stereotyped identity, how will performance be affected?*

It was hypothesized that math-identified females in the Gender/College condition would perform better on the GRE than those in the Gender condition. The data supported this hypothesis. Females in the Gender/College condition performed significantly better than those in the Gender condition by about 1.93 points out of a possible 25 points ($p<0.05$), though not significantly different from the Control condition (shown in Table 9).

Research Question 4: *To what extent can the performance of targets with a positively invoked stereotype vary by the reward structure of the task?*

It was hypothesized that females in the Gender/College condition would do better on the GRE test under a gain/no-gain reward structure than those in the loss/no-loss reward structure. The data do not support this hypothesis, as there was no significant

difference between reward structures for math-identified females in the Gender/College condition. These results can be seen in Table 11.

SUMMARY OF FINDINGS

In summary, it was found that the main effect of experimental condition was significant for math-identified females, with females performing worse in the Gender experimental condition than both the Control and Gender/College conditions. These results were consistent with the hypotheses. This further establishes the role of multiple identities in stereotype threat effects. While the interaction between condition and reward structure was marginally significant, math-identified females under threat did not perform significantly different based on rewards. Additionally, neither threat condition, reward structure, nor the interaction between the two was found significant for math-identified males. Thus, as predicted, this manipulation showed no effect on non-targets of threat which indicates that stereotype threat was invoked and not stereotype priming. More in-depth discussion as well as implications of the findings will be expounded upon in the next chapter.

Chapter 5: Discussion

The purpose of this study was to further research on how multiple identities are related to stereotype threat effects. It proposed that making a positively stereotyped identity, namely membership at a prestigious university, could buffer from the effects of a negatively stereotype identity (that females have lower math ability). While this had been previously studied in the literature, this study sought to reveal why previous experimental manipulations of threat could have been invalid and included a non-target group to ensure the study aligned with the theoretical framework. The second purpose of this study was to examine how characteristics of a social identity, specifically an associated regulatory focus, could explain why sometimes a positive identity has failed to increase performance under stereotype threat. Analysis of the data revealed support for some of the hypothesized relationships, while lack of support for others. The key findings were that the manipulation used only affected targets of threat (math-identified females) and that when presented with a positively stereotyped identity at the same time as a negatively stereotyped identity, performance was better than the negative threat condition, and roughly equal to a neutral threat condition.

Discussion of Findings

Despite increasing academic opportunity and overall educational enrollment, there still remains a large gap in the pursuit of STEM careers by women. If access is not completely addressing this divide, we need to examine other underlying causes. Stereotype threat proposes that psychological factors related to stigma in our immediate situation may not only affect performance at that point in time, but repeated exposure can lead to disidentification with a domain entirely. Despite the depth of the literature on the causes and underlying mechanisms of stereotype threat, the literature is lacking on why

some are immune to its effects. What traits do these resilient people possess that we can try and encourage in others? This study examined how characteristics associated with different aspects of our identity can determine how we react to stereotype threat. Male and female participants were randomly assigned to conditions where one or more aspects of their identity, specifically their gender and college identity, were made more salient by having them answer questions about them. After completing either the gender identity measures or both the gender identity and college identity measures, participants proceeded to take a difficult math test which was described as being diagnostic of ability. A third group to which participants were randomly assigned, the control group, did not complete either measure and were told the following math problems were practice items being tested for future use. This experiment made use of a well-known stereotype that females have lower math ability then males.

Stereotype Priming vs. Stereotype Threat

A major criticism of stereotype threat research is that it does not differentiate itself enough from the study of other theories. While stereotype threat and stereotype priming share characteristics, only stereotype threat must be self-relevant to occur. Thus we, as researchers, need to ensure our methods match the theoretical framework we are working from, especially when studying in an experimental laboratory setting. This study addressed this criticism by providing evidence that the manipulation did not affect a group for whom the negatively stereotyped identity was not relevant.

For math-identified women, when their gender was made salient and they were told they would take a test of math ability, it was predicted that this would invoke stereotype threat. However, as for threat to occur it has to be self-relevant, males were

hypothesized to be unaffected by a negative stereotype about women. The results support the hypothesis that stereotype threat was invoked.

As predicted, when gender was made salient, females performed worse than the control group. Males however performed about the same. This is important because it shows that the manipulation only affected those for whom the stereotype was self- relevant, which is a key piece of the stereotype threat framework. In a pilot study for this dissertation, a commonly used manipulation of stereotype threat was recreated. In it, subjects were explicitly told before taking a difficult math test that females were known to perform worse than males. Unlike many previous studies which used this invocation of threat (e.g., Rydell, McConnell, & Beilock, 2009), this pilot study included non-targets of threat (males). It was shown in the pilot study that males were actually affected when confronted with the negative stereotype about women, and would subsequently underperform relative to a control group. These findings are significant because they support the idea that much of the research on stereotype threat could be in fact studying a different phenomenon, known as stereotype priming.

Another criticism of stereotype threat research has been that it has shown to be difficult to translate to real-world settings. Perhaps this is because researchers have been trying to replicate priming effects in the real world. Future research should synthesize previous findings of stereotype threat research that included non-target groups, while also analyzing how threat was invoked. Previous meta-analyses (Nguyen & Ryan, 2008) have shown somewhat mixed effects for stereotype threat effects on female performance. It is this author's opinion that by only looking at studies which showed no effect on non- targets (and specifically included them in the study for comparison), a more consistent pattern of effects may be found.

Effect of a Positive Identity

Approximately one-third of the participants were assigned to a condition where they answered questions related to both their gender identity as well as their college identity. In relation to mathematical ability, females are negatively stereotyped as being less able than males. Thus when confronted with a diagnostic test of math ability, if this is the only salient identity, it can lead to stereotype threat effects and thus dampen performance. However, members of a competitive and fairly prestigious university are stereotyped to have greater math ability than others. According to social identity theory (Tajfel & Turner, 1986), when both positively and negatively stereotyped aspects of our identity are present, we will suppress the negative one and make the positive identity more prominent. We do this because we want to maintain a positive self-image. When this positively stereotyped identity is more salient, we relax from our hyper-vigilant state and are not subject to stereotype threat. The results from this study support this logic as well, as females reminded of both negatively and positively stereotyped identities, failed to be affected by stereotype threat, as compared to those females who were only reminded of the negatively stereotyped identity.

Making a positively stereotyped identity salient at the same time that a negatively stereotyped identity is salient resulted in no detrimental effects for threat targets. When females were reminded of both their gender and their college membership, they performed better than those in the negative stereotype condition and just as well as those in the threat-neutral condition. These results provide evidence that when both identities were salient, females aligned themselves with the college identity and suppressed their gender identity. As both social identities were positively stereotyped for males, they were never at risk of stereotype threat, and the results support this.

Previous research on the effect of positive identities on targets of threat was mixed, not only in results but also in the methodology used to obtain those results. Shah, Pittinsky, and Ambady (1999) used a subtle manipulation of identity salience, reminding Asian females of either their gender or ethnicity. This resulted in better performance when their Asian identity was salient which was attributed to the stereotype that Asians have high math ability. Gender identity salience resulted in lower performance, consistent with previous stereotype research (Shah, Pittinsky, Ambady, 1999). Cheryan and Bodenhausen (2000) tried to replicate this work but used identity salience manipulations which got more at how one felt about either their ethnicity or gender, how they perceived others to view that identity, as well as how important that identity was to them. For the Asian females in their study, ethnic identity salience actually decreased performance related to the control.

While the current study used the same measures to manipulate threat as Cheryan and Bodenhausen, the effect of the positively stereotyped identity differed. This suggests that ethnic identity is different from college identity and helps support the idea that when considering using positively stereotyped identities as a buffer of stereotype threat, it makes a difference what identity is used. Perhaps the effect of Asian identity in Cheryan and Bodenhausen was negative because when the participants were reminded of their ethnic group membership, this in turn invoked a sense of responsibility to the group which would not have been felt for a college identity group membership. The responsibility of performing well could have actually caused them to "choke" under the pressure. Future research should look into not only determining the boundary conditions of the effects of positively stereotyped identities on stereotype threat, but also continue to isolate the underlying characteristics which moderate these effects.

While the pilot study using the same threat manipulation as Rydell, McConnell, and Beilock (2009) failed to replicate their findings, the current study actually supports them despite having a different threat manipulation. Therefore it provides support for the idea postulated by those researchers, and framed by social identity theory, that having a positively stereotyped identity present when under threat allows one to suppress the negatively stereotyped identity and its corresponding effects. For example, as found in this study, when females were confronted with the negative stereotype about their math ability, having a more positively stereotyped identity (college) available allowed them to align themselves with that and thus not hurt their performance. However, given that the current study uses a different manipulation, it would be useful to replicate these results with the current method of invoking threat (as it was shown to not affect non-targets of threat).

Regulatory Focus

Within each of the three stereotype threat conditions, participants were randomly assigned to a reward structure which either emphasized maximizing gains or minimizing losses. In other words, participants either gained points for each correct response or failed to lose points for correct responses. It has been previously suggested that stereotype threat is actually a mismatch between our current regulatory focus and our reward structure (Grimm et. al, 2009). It was hypothesized that when confronted with a self- relevant negative stereotype, we enter into a prevention regulatory focus and are thus more concerned with minimizing losses. Therefore, in this state we perform best when our reward structure is also aligned with minimizing losses. Following this line of logic, when we align ourselves with a positively stereotyped identity, particularly one which

emphasizes rewards, it was hypothesized that we would perform best under a reward structure that also emphasized maximizing gains.

In the pilot study, it was found that when explicitly primed with statements about performance (males performed better than females, or males performed better than females but college students performed better than others), males actually performed worse when the negative stereotype about females was mentioned. In both the gender threat condition and the gender and college condition, males performed best under a losses reward structure. Females on the other hand performed best under a gains reward structure across conditions. It was suggested that these results differed from the hypothesized results and previous work (Grimm et al., 2009) because making explicit statements about ability and performance was actually a stereotype priming manipulation.

The results from the current study show that reward structure was not a factor in performance as previously predicted, as there was no significant difference by reward structure for either negatively or positively stereotyped identities. The interaction between reward structure and threat condition for females was marginally significant, but pairwise comparisons were not. However, females under stereotype threat trended towards a better performance under a reward structure that maximized gains. This could mean that the females in this study were in more of a promotion fit when confronted with the negatively stereotyped gender condition. Perhaps this differs from previous research (Grimm et al., 2009) because previous studies used a stereotype priming manipulation. Or it could just be that there was not enough statistical power to truly find group differences. Future research should continue this work by replicating the same threat invocation methodology, but with an increased sample size.

Another possible interpretation of these results and why they differed from previous work (Grimm et al., 2009) is that perhaps this manipulation invoked a different

type of stereotype threat. Shapiro and Neuberg (2007) have proposed that there are actually six different types of threat, which vary by the target and source of the threat.

In their Multi-Threat Framework, they argue that there are two main targets of threat, self-concept threat and group-concept threat. Self-concept threats are related to fears of confirming that a negative stereotype about a group one belongs to is true of oneself. So for example, self-concept threat in this study could mean that females were afraid that if they performed poorly, this would make them feel that the negative stereotype about female math ability was true of them. Group-concept threat is related to the fear of confirming that a negative stereotype is true about a group you belong to. For example, females in this study could be concerned that if they performed poorly, this would help confirm the negative stereotype that females were not good at math.

The second dimension of this framework relates to the source of the threat – self, outgroup members, and ingroup members. If self is a source of threat, your concern is that you will confirm the stereotype in your own mind. Similarly, outgroup and ingroup threats relate to the fear you will confirm the negative stereotype in the minds of outgroup members or ingroup members, respectively. So a female in this study could have been concerned that poor performance would lead to confirming the negative stereotype in her own mind, in the minds of males, or in the minds of other females. The intersection of target and source creates six different types of threat: Self/Self, Self/Outgroup, Self/Ingroup, Group/Self, Group/Outgroup, and Group/Ingroup.

In the current study, females under threat actually trended towards better performance in a gains/no-gains reward structure. If this is indeed a true trend, which could be confirmed with additional research, according to regulatory focus theory these females were trying to reduce discrepancies between how they saw themselves now and their ideal self. This could be argued as seeing the threat as a target of the self, rather than

the group to which they belonged. In Grimm et al.'s (2009) study, females performed best under a losses reward structure, meaning they were concerned with responsibilities and security. This would be more consistent if you felt that the group you belonged to was the target of the threat. More research would then be needed to determine if these differences in how participants interpreted the target of threat could explain the difference in results. However, given that this framework has been developed on a body of literature which has failed to differentiate itself enough from stereotype priming, more work is needed in order to determine if this framework holds when only including studies with valid manipulations of threat.

PRACTICAL IMPLICATIONS

The results of the current study hold implications for not only future research on stereotype threat, but for how stereotype threat is approached in the real world. While more research on the effects of multiple identities is needed before prescriptions for practice could be developed, there are certain results which could translate outside of the laboratory. One of the more interesting, yet troubling characteristics of stereotype threat is that it only affects those who consider themselves to excel in a domain. For example, females who do not identify as "math people" are not affected by the stereotype that females have lower ability. But how could a teacher possibly help decrease stereotype threat for females who do identity with the math domain? This research suggests that highlighting another aspect of their identity, perhaps that of a student at a competitive school or a member of an honors program could help buffer from the effects of stereotype threat. Or going even further, what would happen if a college professor told students before an exam that members of their university tended to excel in that area compared to students at other universities? It has been suggested that continuous exposure to

stereotype threat can cause disidentification with a domain. If females continued to receive messages which reminded them of a positively stereotyped identity when under threat, could this decrease their likelihood of leaving math-focused majors?

The results of this research suggest that when doing outreach efforts, you have to look at the intersection of identities. Women reminded of their gender can be less likely to show an interest in pursuing math or science fields and careers (Steele & Ambady, 2006). Therefore, perhaps continuing to remind females of the multiple aspects of their identity when talking about their interests and goals could help prevent them from suppressing this part of themselves. We might speculate, as it has been suggested that repeated exposure to stereotype threat can lead to disidentification over time (Steele, 1997; Major, Spencer, Schmader, Wolfe, & Crocker, 1998; Spencer, Steele, & Quinn, 1999), continuing to hear these messages might prevent females from disidentifying with the domain.

LIMITATIONS AND FUTURE RESEARCH

While this study helped advance the literature on the effect of multiple identities on stereotype threat, it did have limitations which limit the scope of applications but could be addressed by future research.

One limitation of this study is that there might have been insufficient power to truly determine group differences. Several experimental groups contained fewer than 20 participants. It found tendencies towards the effect of reward structure (and corresponding regulatory focus), but these were not significant. More research is needed to tease out the relationship between regulatory focus and multiple identities. If future research confirmed that different social identities were associated with different regulatory foci, then this could lead to the development of some possible interventions

based just on manipulating the reward structure one tests under. However, it would be necessary to confirm that a mismatch would not hurt performance. Therefore, more research is also needed to be able to more accurately predict how threat could invoke a particular regulatory focus.

This study was conducted with university-age participants at a competitive public university, which means that it may not be translatable to other age groups or school populations. Even though using students from this type of institution limits the generalizability, the setting supported the methodology as it was important for identity salience. University lab participants are one of the most accessible subject populations for researchers, but their use in stereotype threat research has been suggested as a weakness of the field. It would therefore benefit the body of literature for this study to be replicated with participants at different stages of development. Furthermore, academic identity is not limited to only one type of post-secondary institution. Therefore, replication with students at a variety of tertiary institutions, from community colleges to Ivy League universities would greatly increase the knowledge of this phenomenon. Additionally, information was not obtained regarding age or year in school for this particular study. Research has shown that some students' academic identification decreases from underclassmen to upperclassmen (Cokley, 2002). It would therefore be useful for future researchers to see if age and school year might play a factor in how invoking a positive college identity buffers stereotype threat.

Despite using items from the Graduate Record Examination, the results from this study should not be used to explain performance on actual standardized tests. As stated previously, it is impossible to recreate a high-stakes testing environment in an experimental laboratory setting. Furthermore, as discussed by Sackett et al. (2004), stereotype threat research should not be used to explain gaps in performance by different

groups. Even under neutral threat, there was a difference in performance by gender with males performing better. Therefore, this research does not propose that making a positively stereotyped identity salient would eliminate this performance difference, but that stereotype threat is one of many factors that should be addressed in closing the gap.

The purpose of this study was to examine effects of stereotype threat on female math performance. Therefore the effects should not be assumed to hold for other marginalized groups, such as ethnic minorities. Future research should look into how positive stereotyped identity salience could counter the threat effects for someone with a negatively stereotyped ethnic identity.

CONCLUSION

This study provided support for the importance of including non-targets of threat in any experiment to ensure its validity. Including this comparative group in the present research allowed to not only validate the methodology of invoking threat but also allowed for the researcher to make legitimate claims about the effects. Thus future research should not only question the methods of invoking stereotype threat but also include non-targets of threat to ensure comparability. This line of research not only exposed flaws in the current way we look at threat, but provided evidence of how to appropriately study it.

Furthermore, this study furthered the knowledge about how multiple identities are related to stereotype threat effects. While results failed to support the use of regulatory fit as an explanatory factor of differentiated effects of identity, they did support the idea that making a positively stereotyped identity salient can buffer from the effects of stereotype threat. This is important because it helps identify a way to possibly counteract the effects of stereotype threat in the moment. If someone continues to receive messages about tapping into their multiple strengths and identities when faced with threat, perhaps this

could prevent disidentification with a domain. More research is needed in order to determine the boundaries of this effect as well as identify how underlying attributes of the identities contribute.

When looking at stigma and its effects, it is important to move away from just examining why some people fail to perform to their level of ability. Instead we need a better understanding of why others remain resilient in spite of prejudice, discrimination, and other evils of society. This research gives evidence to the idea that tapping into our multiple identities, the many different facets of ourselves, is actually a protective coping mechanism that allows us to deal with these perils. It allows us to turn a threat into a challenge.

APPENDIX A: APPROVED IRB

Research Proposal

I. Title: Self-regulation and Quantitative Reasoning

II. Investigators (co-investigators): Alyssa Reinhart
Faculty Advisor: Dr. Keisha Bentley-Edwards

III. Hypothesis, Research Questions, or Goals of the Project

This is an exploratory study to determine what the relationship is between multiple identities and regulatory focus, and stereotype threat. In a previous study, stereotype threat was reinterpreted through a regulatory focus framework. This study seeks to marry that work, with literature on the relationship between multiple identities and stereotype threat, self-construal and regulatory focus, and stereotype threat. The goal of this research is to be used to complete the requirements for a dissertation.

IV. Background and Significance:

First identified in 1995 by Steele and Aronson, stereotype threat is defined as "being at risk of confirming, as self-characteristic, a negative stereotype about one's group." Repeated experiments have shown a decrease in performance for minority students and women when a negative stereotype is activated, as opposed to a control group. Numerous studies in peer-reviewed journals have shown that this performance decrement occurs not only in the laboratory, but in real-world contexts as well (Grimm et al., 2009). Many believe that the reason that it occurs is that it causes a decrease in working memory, either part of the resources being taken over by anxiety, or that resources are devoted to tasks which are usually automatic, thus resulting in fewer mental resources to tackle the given task (Beilock, Rydell, & McConnell, 2007). Others believe that the cause is due to a regulatory focus mismatch, wherein in trying to avoid confirming the stereotype, marginalized groups will choose a regulatory focus that does not fit the task (Grimm et al., 2009). One possible intervention for stereotype threat, proposed by Rydell, McConnell, and Beilock (2009), is to show both the negative stereotype (i.e. females tend to perform poorly on this test) as well as another positive stereotype (i.e. college students tend to perform well on this test), thus inducing a multiple identity outlook. In a series of experiments, this procedure seemed to protect participants from the negative effect of stereotype threat on performance. The purpose of this study is to replicate the multiple identity experiment on stereotype threat, but to analyze it from a regulatory focus framework.

V. Research Method, Design, and Proposed Statistical Analysis:

This experiment will examine performance on GRE problems. The reward structure of the task will be manipulated so that one group will gain points for responses, earning points for correct responses but not earning points for incorrect responses; another group will lose points for incorrect responses, but will not lose points for correct responses. Additionally the type of threat condition will be manipulated.
Participants will complete a regulatory focus questionnaire as well as a math identity and anxiety questionnaire. Participants will have been randomly assigned to either an early stereotype threat condition, where they will be told that the following quantitative test is diagnostic of ability, or to a control condition, where they will be told the task is just for fun (and to validate the questions).
The participants will be randomly assigned to one of five identity manipulations: a control condition with no measures; a gender condition, where they will answer items from the Collective Self-Esteem Scale in relation to their gender group; an ethnicity condition where they will answer items from the Collective Self-Esteem Scale in relation to their ethnic group; a gender and college condition where they will answer items from the Collective Self-Esteem Scale in relation to both their gender group as well as college identity; and an ethnicity and college condition, where they will answer items from the Collective Self-Esteem Scale in relation to their ethnic group and college identity.
Next the participants will be randomly assigned to one of the two reward structures (gains vs. losses) and complete approximately 25 quantitative GRE questions. Finally, students will complete questionnaires about their emotions during the test (regulatory fit), whether they thought about their identity during the test (threat-based concerns), as well as a series of demographic questions, including their SAT score. Once everything is completed, the participants will be debriefed about the real purpose of the study as well as informed about stereotype threat in general.

VI. Human Subject Interactions

A. <u>Sources of Potential Participants:</u>

For this study we will use students from the educational psychology department subject pool. Up to four hundred students of diverse ages, backgrounds, classifications, and majors will participate in the study. The participants are not likely to be vulnerable to any coercion in this study. All of the students will be informed of the purpose of the study and participation will be voluntary. Also

participants will be instructed that they do not have to answer any questions that make them uncomfortable and that they are able to leave at any time during the study. Students who leave will be given alternative options for receiving subject pool credit. All study participants are expected to be 18 years of age or older and English speaking.

B. Procedures for the Recruitment of the Participants.

Students will be recruited using the Educational Psychology subject pool procedures. Subjects will be informed of the option to complete an alternate assignment.

C. Procedure for Obtaining Informed Consent.

When the students arrive, a website address will be displayed on the white board which contains the links to the respective survey elements. Informed consent will be obtained online through web-based survey software, overseen by the investigators in the lab when the students arrive. This form will be a separate survey from the rest of study. After students have been briefed on the procedure, expectations, risks, benefits, and study credit, students will read the informed consent form online. An investigator will explain each of the sections on the consent and offer to answer any questions or provide any additional clarification as needed. Once the students have had an opportunity to read the form and ask any questions they may have, the participants will be invited to consent to participation online by selecting an "I agree" button on the same page as the consent form. All participants will be given a hard copy of the consent form for their own records (see Informed Consent document). Students who do not wish to participate will be dismissed and invited to contact their instructor for an alternate credit method. As this study meets criteria for the waiver of documentation (minimal risk and the research activities would not require written consent when performed outside a research setting), we are requesting a waiver of documentation of informed consent.

D. Research Protocol.

The purpose of the study is to examine if there is a relationship between multiple identities to regulatory focus, and therefore to stereotype threat.

All students will be required to attend one experimental session, lasting approximately two hours, in the computer lab in the Sanchez building. Students will sign up for a session via the online Subject Pool website. Upon entering the computer lab, participants will be checked in using their student ID cards against the online list of students who signed up. They will then be issued an ID number, written on a piece of paper, and will be asked to take a seat until all participants have arrived and checked in. Then the study instructions will be given and the students will begin the survey. The survey data will be collected anonymously via a web-based software system (Qualtrics); the system is password-protected so that only the researchers will have access to the collected responses. The first question will ask them to record their assigned number – this will ensure that they are not entering any identifying information in the survey. When they are finished with the survey, they will notify the researcher who will ensure they have finished before dismissing them. When the participants are finished, they will check back in with the researcher and return their number. Qualtrics has a progress meter which can show how far along each of the ID numbers are in the survey; if the student's ID number shows that they have completed the survey, then their credit will be recorded in the Subject Pool website. This ensures that both the student has completed their credit, as well as no identifying information links the student to their survey responses. ID numbers are recycled after each session.

E. Privacy and Confidentiality of Participants

In order to protect the privacy of the participants, the instructions will include that they do not have to answer every question and that they are free to leave at any time during the session. Participation will be strictly voluntary. Confidentiality will be protected because student responses on the questionnaires and on the test questions will be anonymous. All of the information collected via the web-based software will be free of identifiable markers and only associated with participant number.

F. Confidentiality of the Research Data.

Study response data (which is independent of informed consent and participation data discussed earlier) will be contained on password-protected web-based software (Qualtrics), as well as downloaded to the personal computer of the primary investigator. Once the data is downloaded, the files will be protected by passwords. Only the researchers will have access to the responses.

Participants' names will not be connected to their participant number. The purpose of the participant number is to be able to easily identify particular cases, not connect them with specific persons. The survey data will be removed from Qualtrics, but study materials and de-identified data will be retained by the PI indefinitely so that data can be used in future research.

G. Research Resources

We will have one principal investigator to conduct the data collection. A password-protected web-based survey program (Qualtrics) will be used. The study will be conducted in the computer labs in the Sanchez building on the UT Austin campus.

VII. Potential Risks

It is very unlikely that there are any risks involved in this study beyond that which would be encountered in everyday life.

VIII. Potential Benefits

There are no direct benefits for the participants of this study recruited from the subject pool. However, some studies indicate that knowing about stereotype threat can actually "inoculate" persons to its effects. During the debriefing at the end of the experiment, the investigator will explain to the participants about this phenomenon.

IX. External Sites or Agencies Involved

We will not use any resources or sites outside of the University of Texas at Austin.

X. Review by another IRB: n/a

APPENDIX B: MEASURES

Demographic Questions

Please indicate your gender:
Male
Female

Which college do you belong to?
Cockrell School of Engineering
College of Communication
College of Education
College of Fine Arts
College of Liberal Arts
College of Natural Sciences
College of Pharmacy
Graduate School
Jackson School of Geosciences
Lyndon B. Johnson School of Public Affairs
McCombs School of Business
School of Architecture
School of Information
School of Law
School of Nursing
School of Social Work
School of Undergraduate Studies
Other (please specify)

My ethnicity is:
Asian or Asian American, including Chinese, Japanese, and others
Black or African American
Hispanic or Latino, including Mexican American, Central American, and others
White, Caucasian, Anglo, European American; not Hispanic
American Indian/Native American
Mixed; Parents are from two different groups
Other (write in)

Please indicate the degree to which you agree with the following statements.

(1) I am good at math.

(1)	(2)	(3)	(4)	(5)
Strongly Agree	Agree	Neither Agree Nor Disagree	Disagree	Strongly Disagree

(2) It is important to me that I am good at math.

(1)	(2)	(3)	(4)	(5)
Strongly Agree	Agree	Neither Agree Nor Disagree	Disagree	Strongly Disagree

(3) I dread mathematics class.

(1)	(2)	(3)	(4)	(5)
Strongly Agree	Agree	Neither Agree Nor Disagree	Disagree	Strongly Disagree

(4) Working on mathematics problems makes me tense.

(1)	(2)	(3)	(4)	(5)
Strongly Agree	Agree	Neither Agree Nor Disagree	Disagree	Strongly Disagree

(5) Mathematics is easier for me than it is for most people.

(1)	(2)	(3)	(4)	(5)
Strongly Agree	Agree	Neither Agree Nor Disagree	Disagree	Strongly Disagree

(6) I just cannot understand mathematics.

(1)	(2)	(3)	(4)	(5)
Strongly Agree	Agree	Neither Agree Nor Disagree	Disagree	Strongly Disagree

(7) If I ever need to learn new mathematics for my job, it will be easy for me.

(1)	(2)	(3)	(4)	(5)
Strongly Agree	Agree	Neither Agree Nor Disagree	Disagree	Strongly Disagree

Regulatory Focus Questionnaire

(Higgins, Friedman, Harlow, Idson, Ayduk, & Taylor, 2001)

Instructions

Read each statement carefully and use the scales to rate your opinions.

1) Compared to most people, are you typically unable to get what you want out of life?

(1)	(2)	(3)	(4)	(5)
Never or seldom		Sometimes		Very often

2) Growing up, would you ever "cross the line" by doing things that your parents would not tolerate?

(1)	(2)	(3)	(4)	(5)
Never or seldom		Sometimes		Very often

3) How often have you accomplished things that got you "psyched" to work even harder?

(1)	(2)	(3)	(4)	(5)
Never or seldom		A few times		Many times

4) Did you get on your parents' nerves often when you were growing up?

(1)	(2)	(3)	(4)	(5)
Never or seldom		Sometimes		Very often

5) How often did you obey rules and regulations that were established by your parents?

(1)	(2)	(3)	(4)	(5)
Never or seldom		Sometimes		Very often

6) Growing up, did you ever act in ways that your parents thought were objectionable?

(1)	(2)	(3)	(4)	(5)
Never or seldom		Sometimes		Very often

Do you often do well at different things that you try?

(1)	(2)	(3)	(4)	(5)
Never or seldom		Sometimes		Very often

Not being careful enough has gotten me into trouble at times.

(1)	(2)	(3)	(4)	(5)
Never or seldom		Sometimes		Very often

When it comes to achieving things that are important to me, I find that I don't perform as well as I ideally would like to do.

(1)	(2)	(3)	(4)	(5)
Never true		Sometimes true		Very often true

I feel like I have made progress toward being successful in my life.

(1)	(2)	(3)	(4)	(5)
Certainly false				Certainly true

I have found very few hobbies or activities in my life that capture my interest or motivate me to put effort into them.

(1)	(2)	(3)	(4)	(5)
Certainly false				Certainly true

A Collective Self-Esteem Scale: Self-Evaluation of One's Social Identity

(Luhtanen & Crocker, 1989) and Modified CSES (Ethier & Deaux, 1990)

Instructions

Below is a list of statements dealing with your general feelings about yourself. Please indicate how strongly you agree or disagree with each statement.

Modified Scale for Gender

Private

I often regret that I belong to the gender group I do.

(1)	(2)	(3)	(4)	(5)	(6)	(7)
Strongly Disagree			Neither Agree nor Disagree			Strongly Agree

In general, I'm glad to be a member of the gender group I belong to.

(1)	(2)	(3)	(4)	(5)	(6)	(7)
Strongly Disagree			Neither Agree nor Disagree			Strongly Agree

Overall, I often feel that the gender of which I am a member is not worthwhile.

(1)	(2)	(3)	(4)	(5)	(6)	(7)
Strongly Disagree			Neither Agree nor Disagree			Strongly Agree

I feel good about the gender I belong to.

(1)	(2)	(3)	(4)	(5)	(6)	(7)
Strongly Disagree			Neither Agree nor Disagree			Strongly Agree

Public

Overall, my gender is considered good by others.

(1)	(2)	(3)	(4)	(5)	(6)	(7)
Strongly Disagree			Neither Agree nor Disagree			Strongly Agree

Most people consider my gender, on the average, to be more ineffective than the other gender.

(1)	(2)	(3)	(4)	(5)	(6)	(7)
Strongly Disagree			Neither Agree nor Disagree			Strongly Agree

In general, others respect the gender group that I am a member of.

(1)	(2)	(3)	(4)	(5)	(6)	(7)
Strongly Disagree			Neither Agree nor Disagree			Strongly Agree

In general, others think that the gender group I am a member of is unworthy.

(1)	(2)	(3)	(4)	(5)	(6)	(7)
Strongly Disagree			Neither Agree nor Disagree			Strongly Agree

Importance

Overall, my gender has very little to do with how I feel about myself.

(1)	(2)	(3)	(4)	(5)	(6)	(7)
Strongly Disagree			Neither Agree nor Disagree			Strongly Agree

My gender is an important reflection of who I am.

(1)	(2)	(3)	(4)	(5)	(6)	(7)
Strongly Disagree			Neither Agree nor Disagree			Strongly Agree

My gender is unimportant to my sense of what kind of person I am.

(1)	(2)	(3)	(4)	(5)	(6)	(7)
Strongly Disagree			Neither Agree nor Disagree			Strongly Agree

In general, my gender is an important part of my self-image.

(1)	(2)	(3)	(4)	(5)	(6)	(7)
Strongly Disagree			Neither Agree nor Disagree			Strongly Agree

Modified Scale for College Identity

Membership

I am a worthy member of the university I belong to.

(1)	(2)	(3)	(4)	(5)	(6)	(7)
Strongly Disagree			Neither Agree nor Disagree			Strongly Agree

I feel I don't have much to offer to the university I belong to.

(1)	(2)	(3)	(4)	(5)	(6)	(7)
Strongly Disagree			Neither Agree nor Disagree			Strongly Agree

I am a cooperative participant in the university I belong to.

(1)	(2)	(3)	(4)	(5)	(6)	(7)
Strongly Disagree			Neither Agree nor Disagree			Strongly Agree

I often feel I'm a useless member of my university.

(1)	(2)	(3)	(4)	(5)	(6)	(7)
Strongly Disagree			Neither Agree nor Disagree			Strongly Agree

Private

I often regret that I belong to the university I do.

(1)	(2)	(3)	(4)	(5)	(6)	(7)
Strongly Disagree			Neither Agree nor Disagree			Strongly Agree

In general, I'm glad to be a member of the university I belong to.

(1)	(2)	(3)	(4)	(5)	(6)	(7)
Strongly Disagree			Neither Agree nor Disagree			Strongly Agree

Overall, I often feel that the university of which I am a member is not worthwhile.

(1)	(2)	(3)	(4)	(5)	(6)	(7)
Strongly Disagree			Neither Agree nor Disagree			Strongly Agree

I feel good about the university I belong to.

(1)	(2)	(3)	(4)	(5)	(6)	(7)
Strongly Disagree			Neither Agree nor Disagree			Strongly Agree

Public

Overall, my university is considered good by others.

(1)	(2)	(3)	(4)	(5)	(6)	(7)
Strongly Disagree			Neither Agree nor Disagree			Strongly Agree

Most people consider my university, on the average, to be more ineffective than other universities.

(1)	(2)	(3)	(4)	(5)	(6)	(7)
Strongly Disagree			Neither Agree nor Disagree			Strongly Agree

In general, others respect the university that I am a member of.

(1)	(2)	(3)	(4)	(5)	(6)	(7)
Strongly Disagree			Neither Agree nor Disagree			Strongly Agree

In general, others think that the university I am a member of is unworthy.

(1)	(2)	(3)	(4)	(5)	(6)	(7)
Strongly Disagree			Neither Agree nor Disagree			Strongly Agree

Importance

Overall, being a member of my university has very little to do with how I feel about myself.

(1)	(2)	(3)	(4)	(5)	(6)	(7)
Strongly Disagree			Neither Agree nor Disagree			Strongly Agree

The university I belong to is an important reflection of who I am.

(1)	(2)	(3)	(4)	(5)	(6)	(7)
Strongly Disagree			Neither Agree nor Disagree			Strongly Agree

The university I belong to is unimportant to my sense of what kind of person I am.

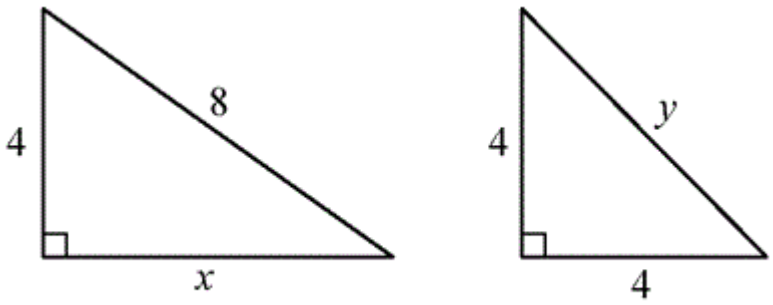
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Strongly Disagree			Neither Agree nor Disagree			Strongly Agree

In general, belonging to my university is an important part of my self-image.

(1)	(2)	(3)	(4)	(5)	(6)	(7)
Strongly Disagree			Neither Agree nor Disagree			Strongly Agree

Graduate Record Examination (GRE) Quantitative Questions

Please answer the following questions to the best of your ability. You may use scratch paper if you would like. You will have 40 minutes to complete this section.



1)
Quantity A: x

Quantity B: y

From the answer choices given, select and indicate the one that describes the relationship between quantity A and quantity B.

A. Quantity A is greater.

B. Quantity B is greater.

C. The two quantities are equal.

D. The relationship cannot be determined from the information given.

2) It is given that $(x - 2y)(x + 2y) = 4$

Quantity A: $x^2 - 4y^2$

Quantity B: 8

From the answer choices given, select and indicate the one that describes the relationship between quantity A and quantity B.

A. Quantity A is greater.

B. Quantity B is greater.

C. The two quantities are equal.

D. The relationship cannot be determined from the information given.

3) A certain recipe requires 3/2 cups of sugar and makes 2 dozen cookies.

Quantity A: The amount of sugar required for the same recipe to make 30 cookies

Quantity B: 2 cups

From the answer choices given, select and indicate the one that describes the relationship between quantity A and quantity B.

A. Quantity A is greater.

B. Quantity B is greater.

C. The two quantities are equal.

D. The relationship cannot be determined from the information given.

4) A power station is located on the boundary of a square region that measures 10 miles on each side. Three substations are located inside the square region.

Quantity A: The sum of the distances from the power station to each of the substations

Quantity B: 30 miles

From the answer choices given, select and indicate the one that describes the relationship between quantity A and quantity B.

A. Quantity A is greater.

B. Quantity B is greater.

C. The two quantities are equal.

D. The relationship cannot be determined from the information given.

5) It is given that 6 is less than x, which is less than 7, and y = 8

Quantity A: x/y

Quantity B: 0.85

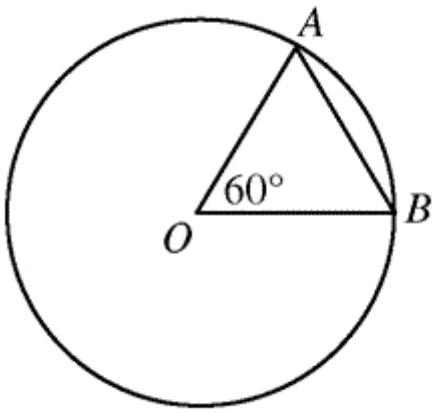
From the answer choices given, select and indicate the one that describes the relationship between quantity A and quantity B.

A. Quantity A is greater.

B. Quantity B is greater.

C. The two quantities are equal.

D. The relationship cannot be determined from the information given.



6)

It is given that O is the center of the circle and the perimeter of triangle B O A is 6.

Quantity A: The circumference of the circle

Quantity B: 12

From the answer choices given, select and indicate the one that describes the relationship between quantity A and quantity B.

A. Quantity A is greater.

B. Quantity B is greater.

C. The two quantities are equal.

D. The relationship cannot be determined from the information given.

7) This question has five answer choices, labeled A through E. Select the best one of the answer choices given. The system of equations

$7x + 3y = 12$, and

$3x + 7y = 6$ is given.

If x and y satisfy the system of equations given, what is the value of x-y?

A. 2/3

B. 3/2

C. 1

D. 4

E. 6

8) This question has five answer choices, labeled A through E. Select the best one of the answer choices given. If $(55x)(25) = 5n$, where n and x are integers, what is the value of n in terms of x.

A. $5x + 1$

B. $5x + 2$

C. $5x + 5$

D. $10x$

E. $10x + 2$

9) This question has five answer choices, labeled A through E. Select the best one of the answer choices given. In the sunshine, an upright pole 12 feet tall is casting a shadow 8

feet long. At the same time, a nearby upright pole is casting a shadow 10 feet long. If the lengths of the shadows are proportional to the heights of the poles, what is the height, in feet, of the taller pole?

A. 10

B. 12

C. 14

D. 15

E. 18

10) This question has five answer choices, labeled A through E. Select the best one of the answer choices given. If k is the smallest prime number greater than 21 and b is the largest prime number less than 16, then kb =

A. 299

B. 323

C. 330

D. 345

E. 351

11) This question has five answer choices, labeled A through E. Select the best one of the answer choices given.

List R: 28, 23, 30, 25, 27

List S: 22, 19, 15, 17, 20 The median of the numbers in list R is how much greater than the median of the numbers in list S?

A. 8

B. 10

C. 12

D. 13

E. 15

12) This question has five answer choices, labeled A through E. Select the best one of the answer choices given. Each month, a certain manufacturing company's total expenses are equal to a fixed monthly expense plus a variable expense that is directly proportional to the number of units produced by the company during that month. If the company's total expenses for a month in which it produces 20,000 units are $570,000, and the total expenses for a month in which it produces 25,000 units are $705,000, what is the company's fixed monthly expense?

A. $27,000

B. $30,000

C. $67,500

D. $109,800

E. $135,000

13) It is given that x is greater than 1.

Quantity A: $x(x^2)^4$

Quantity B: $(x^3)^3$

From the answer choices given, select and indicate the **one** that describes the relationship between quantity A and quantity B.

A. Quantity A is greater.

B. Quantity B is greater.

C. The two quantities are equal.

D. The relationship cannot be determined from the information given.

14) It is given that *x* is not equal to 0.

Quantity A: |x| + |-2|

Quantity B: |x-2|

From the answer choices given, select and indicate the **one** that describes the relationship between quantity A and quantity B.

A. Quantity A is greater.

B. Quantity B is greater.

C. The two quantities are equal.

D. The relationship cannot be determined from the information given.

15) This question has five answer choices, labeled A through E. Select the best **one** of the answer choices given. If c and d are positive integers and m is the greatest common factor of c and d, then m must be the greatest common factor of c and which of the following integers?

A. c + d

B. 2 + d

C. cd

D. 2d

E. d^2

16) It is given that x is a positive integer and y is a negative integer. From the answer choices given, select and indicate the **one** that describes the relationship between quantity A and quantity B.

Quantity A: x – y

Quantity B: y – x

A. Quantity A is greater.

B. Quantity B is greater.

C. The two quantities are equal.

D. The relationship cannot be determined from the information given.

17) The arithmetic mean of 100 measurements is 23, and the arithmetic mean of 50 additional measurements is 27. From the answer choices given, select and indicate the **one** that describes the relationship between quantity A and quantity B.

Quantity A. The arithmetic mean of the 150 measurements

Quantity B: 25

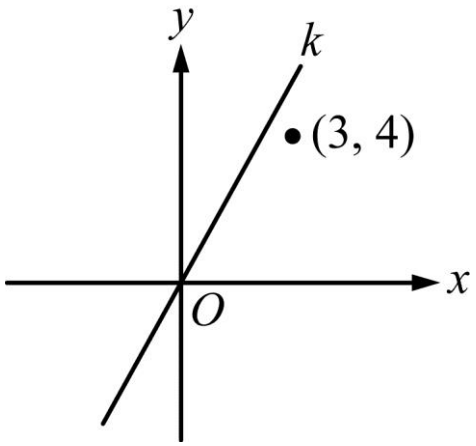
A. Quantity A is greater.

B. Quantity B is greater.

C. The two quantities are equal.

D. The relationship cannot be determined from the information given.

18)



From the answer choices given, select and indicate the **one** that describes the relationship between quantity A and quantity B.

Quantity A: The slope of line k

Quantity B: 1

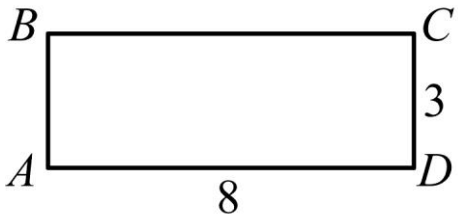
A. Quantity A is greater.

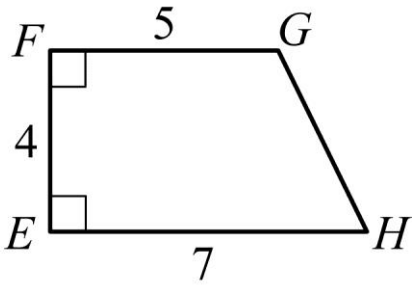
B. Quantity B is greater.

C. The two quantities are equal.

D. The relationship cannot be determined from the information given.

19) The original price of a suit was 30 percent less than the suit's $250 suggested retail price. The price at which the suit was sold was 20 percent less than the original price. From the answer choices given, select and indicate the **one** that describes the relationship between quantity A and quantity B.
Quantity A: The price at which the suit was sold
Quantity B: 50% of the suit's suggested retail price
A. Quantity A is greater.
B. Quantity B is greater.
C. The two quantities are equal.
D. The relationship cannot be determined from the information given.



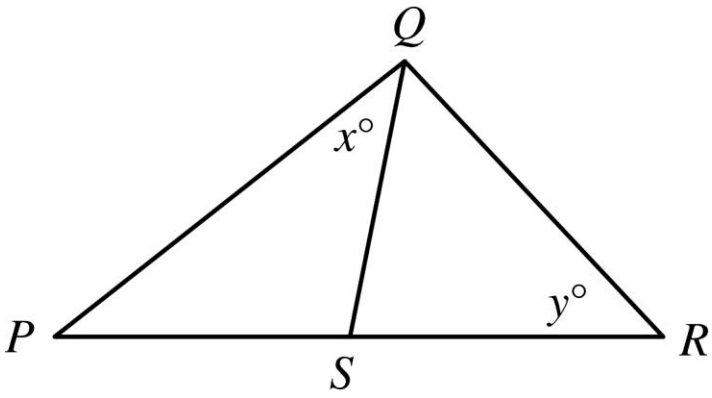


20)
From the answer choices given, select and indicate the **one** that describes the relationship between quantity A and quantity B.
Quantity A: The area of rectangle ABCD
Quantity B: The area of trapezoidal region EFGH
A. Quantity A is greater.
B. Quantity B is greater.
C. The two quantities are equal.
D. The relationship cannot be determined from the information given.

21) In State *X*, all vehicle license plates have 2 letters from the 26 letters of the alphabet followed by 3 one digit numbers. How many different license plates can State *X* have if

repetition of letters and numbers is allowed? Select and indicate the best **one** of the answer choices given.
A. 23,400
B. 60,840
C. 67,600
D. 608,400
E. 676,000

22) The probability that events *E* and *F* will both occur is 0.42. From the answer choices given, select and indicate the **one** that describes the relationship between quantity A and quantity B.
Quantity A: The probability that event *E* will occur
Quantity B: 0.58
A. Quantity A is greater.
B. Quantity B is greater.
C. The two quantities are equal.
D. The relationship cannot be determined from the information given.



23)
It is given that the length of line segment PS is equal to the length of line segment. From the answer choices given, select and indicate the **one** that describes the relationship between quantity A and quantity B.
Quantity A: The probability that event *E* will occur
Quantity B: 0.58
A. Quantity A is greater.
B. Quantity B is greater.
C. The two quantities are equal.
D. The relationship cannot be determined from the information given.

24) If j and k are integers and j – k is even, which of the following must be even? Select and indicate the best one of the answer choices given.
A. k
B. jk

C. $j + 2k$
D. $jk + j$
E. $jk - 2j$

25) If p is a negative number and $0 < s < |p|$, which of the following must also be a negative number? Select and indicate the best one of the answer choices given.
A. $(p + s)^2$
B. $(p - s)^2$
C. $(s - p)^2$
D. $p^2 - s^2$
E. $s^2 - p^2$

Measure of Regulatory Fit

(Adapted from Keller & Dauenheimer, 2003 and Roney et al., 1995)

Instructions

Please indicate the degree to which you felt the following emotions while completing the math test:

Tense

(1)	(2)	(3)	(4)	(5)	(6)	(7)
Not at All			Moderately			Very Much

Disappointed

(1)	(2)	(3)	(4)	(5)	(6)	(7)
Not at All			Moderately			Very Much

Unconcerned

(1)	(2)	(3)	(4)	(5)	(6)	(7)
Not at All			Moderately			Very Much

Sad

(1)	(2)	(3)	(4)	(5)	(6)	(7)
Not at All			Moderately			Very Much

Quiet

(1)	(2)	(3)	(4)	(5)	(6)	(7)
Not at All			Moderately			Very Much

Frustrated

(1)	(2)	(3)	(4)	(5)	(6)	(7)
Not at All			Moderately			Very Much

Self-Conscious

(1)	(2)	(3)	(4)	(5)	(6)	(7)
Not at All			Moderately			Very Much

Content

(1)	(2)	(3)	(4)	(5)	(6)	(7)
Not at All			Moderately			Very Much

Calm

(1)	(2)	(3)	(4)	(5)	(6)	(7)
Not at All			Moderately			Very Much

Nervous

(1)	(2)	(3)	(4)	(5)	(6)	(7)
Not at All			Moderately			Very Much

Enthusiastic

(1)	(2)	(3)	(4)	(5)	(6)	(7)
Not at All			Moderately			Very Much

Agitated

(1)	(2)	(3)	(4)	(5)	(6)	(7)
Not at All			Moderately			Very Much

Light-hearted

(1)	(2)	(3)	(4)	(5)	(6)	(7)
Not at All			Moderately			Very Much

Uncertain

(1)	(2)	(3)	(4)	(5)	(6)	(7)
Not at All			Moderately			Very Much

Happy

(1)	(2)	(3)	(4)	(5)	(6)	(7)
Not at All			Moderately			Very Much

Depressed

(1)	(2)	(3)	(4)	(5)	(6)	(7)
Not at All			Moderately			Very Much

Balanced

(1)	(2)	(3)	(4)	(5)	(6)	(7)
Not at All			Moderately			Very Much

Anxious

(1)	(2)	(3)	(4)	(5)	(6)	(7)
Not at All			Moderately			Very Much

Measure of Threat-Based Concerns

(Adapted from Marx & Stapel, 2006 and Keller & Dauenheimer, 2003)

Gender-Based Concerns

1. I worry that my ability to perform well on math tests is affected by my gender.

(1)	(2)	(3)	(4)	(5)	(6)	(7)
Not at All			Moderately			Very Much

2. I worry that, because I know the negative stereotype about women and math, my anxiety about confirming that stereotype will negatively influence how I perform on math tests.

(1)	(2)	(3)	(4)	(5)	(6)	(7)
Not at All			Moderately			Very Much

3 I worry that if I perform poorly on this test, the experimenter will attribute my poor performance to my gender.

(1)	(2)	(3)	(4)	(5)	(6)	(7)
Not at All			Moderately			Very Much

4. I thought about the fact that my own performance has an impact on the result of my gender group.

(1)	(2)	(3)	(4)	(5)	(6)	(7)
Not at All			Moderately			Very Much

5. I was afraid that my poor performance would worsen the result of my gender group.

(1)	(2)	(3)	(4)	(5)	(6)	(7)
Not at All			Moderately			Very Much

APPENDIX C: FIGURES

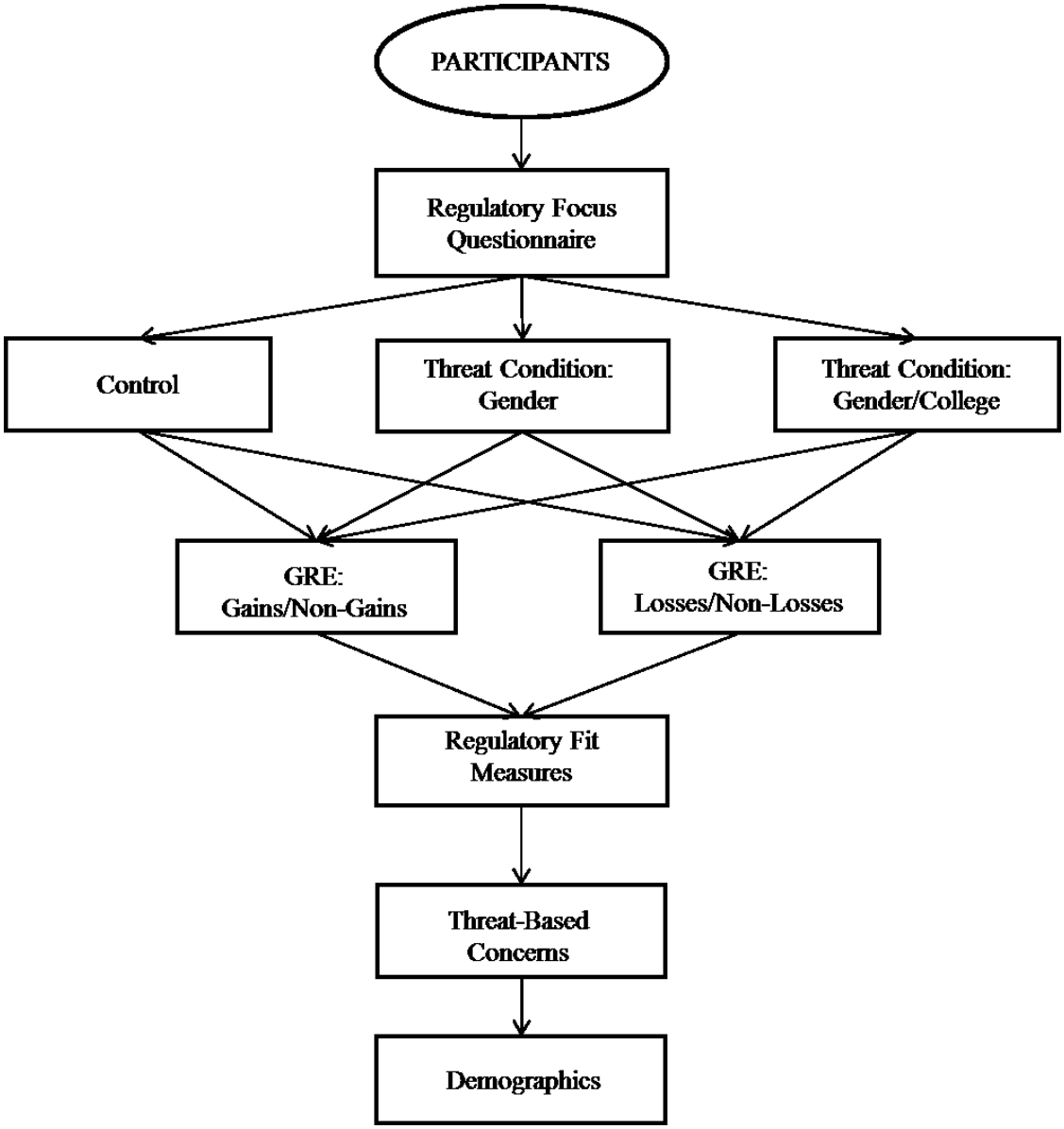


Figure 1. Research Design. Threat is invoked by framing the task as diagnostic of math ability. Identities are invoked through the use of modified versions of the Collective Self-Esteem Scale about gender, ethnicity, or college identity.

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